

U.S. Department of Energy  
NNSA/NA-42  
Office of Emergency Response  
Nuclear Incident Team Operations

**Event Date:** 8, 10, 12, 13, 22, 24, 25 Oct 14

**Event Type:** Actual

**Urgency:** Within 4 hours

**Location:** Boise, Idaho

**Callout -**

Bridge Open: 11, 13, 16 Oct 14

Bridge Close: Various

Report Date: 16 Dec14

Revision #: 6.1

**Edited by:** DOE Triage Program

**Request submitted by -**

Organization(s) -

DOE RAP Team 6, in support of  
U.S. EPA Region 10

## TRIAGE INCIDENT REPORT

### *Survey of Residence in Boise, Idaho*

#### **SUMMARY (TE-14-2148, INCLUDING ADDENDUMS A THROUGH AE)**

In support of U.S. EPA Region 10, a DOE RAP Region 6 team performed gamma assays associated with a residence, garage, and passenger cars in Boise, Idaho. Triage received thirty five spectrum files for assessment, each with backgrounds and knowns. Automated field RIID reporting indicated U-235, U-238, and various other nuclides. Triage was requested to: identify and quantify nuclides, assess evidence for chemical processing of uranium, and estimate uranium isotopic compositions.

#### **ASSESSMENT:**

Triage assesses 17 of 35 unknown gamma spectra reflected natural or depleted uranium: in chemically separated forms of uranium oxide powders, liquid solutions, or metal items; or, as unseparated uranium and thorium ores. Also identified are commercial products containing Ra-226 (clock dials), Am-241 (smoke detectors), and Sb-125 (Mo-99/Tc-99m cow with trace secondary fission products). All items are not consistent with enriched uranium (either low- or highly-enriched).

In overall photos, Triage notes no industrial processing equipment of the type and scale necessary to chemically extract natural uranium from ore, then produce chemically purified uranium oxide compounds in the quantities observed. Indicative waste streams are also absent. Triage assesses it more likely that commercial purchases were made of natural uranium oxide and depleted uranium items, which are both available in legitimate transactions. Solution unknowns assessed to contain natural/depleted uranium may be inorganic acid solutions (nitric/sulfuric/hydrochloric), since uranium metal and oxides are insoluble in water alone. Commercial items present contain Ra-226 and Am-241 in quantities that may present dispersal hazards.

Triage assesses no imminent nuclear/radiological threat, and no concern of threat masking. Conclusions for all items are assigned high confidence.

#### **SITUATION**

In support of the EPA Region 10, RAP Team 6 performed extended radiological assessments of locations in Boise, Idaho. The two initial assays were collected for the highest beta-gamma count rate locations in a personal residence and vehicle. Further spectrum files were collected of individual items, surface contamination locations, as well as kitchen, closet, and bathroom areas. EPA, NRC, and the Idaho Department of Environmental Quality will use DOE reporting in decisions on regulatory compliance and disposition. The response has continued with other companion Triage submissions, including at least TE-14-2253.

#### **DATA**

##### **DATA FILES**

TE-14-2148 Main: Chemical Container (Ortec Detective EX100, S/N 7015)

b-BKG.spc	Background	10 Oct 14
k-Known (Cs-137 10uCi) .spc	Known Source	10 Oct 14
i-Lead Pig(long count).spc	Questioned Item	10 Oct 14
o-Lead Shield .JPG	Photo	10 Oct 14
o-P1000030.JPG	Photo	10 Oct 14
o-[RAP Team 6] Pictures.docx	Photo	10 Oct 14
o-Photo Log – [Boise] apartment.docx	Photo	10 Oct 14

(Cont.)

## Addendum A: Car Trunk Flooring (Ortec Detective EX100, S/N 4045)

b-Solas Car Trunk Background.spc	Background	10 Oct 14
k-Soltas Car Know (Th-232 End Cap).spc	Known Source	10 Oct 14
i-Soltas Car Trunk Item of Interest.spc	Questioned Item	10 Oct 14
o-P1000019.JPG	Photo	10 Oct 14
o-P1000021.JPG	Photo	10 Oct 14

## Addendum B: 2nd Private Vehicle Trunk (Photo Only)

o-IMG_2030 (1).jpg	Photo	8 Oct 14
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## Addendum C: Black Cube Item (Ortec Detective EX100, S/N 4045)

k-2014_10_12_12_19_Known Th Cap.spc	Known Source	12 Oct 14
b-Apartment BKG.spc	Background	12 Oct 14
i-Black Cube Bathroom.spc	Questioned Item	12 Oct 14
o-P1000020.JPG	Photo	12 Oct 14
o-P1000025.JPG	Photo	12 Oct 14
o-P1000037.JPG	Photo	12 Oct 14

## Addendum D: Outdoor Black Powder (Ortec Detective EX100, S/N 4045)

k-2014_10_12_12_19_Known Th Cap.spc	Known Source	12 Oct 14
b-Apartment BKG.spc	Background	12 Oct 14
i-Outdoor Patio Powder.spc	Questioned Item	12 Oct 14
o-P1000015.JPG	Photo	12 Oct 14
o-P1000031.JPG	Photo	12 Oct 14

## Addendum E: Male Bedroom (Ortec Detective EX100, S/N 4045)

k-2014_10_12_12_19_Known Th Cap.spc	Known Source	12 Oct 14
b-Apartment BKG.spc	Background	12 Oct 14
i-Male Bedroom.spc	Questioned Item	12 Oct 14
o-P1000047.JPG	Photo	12 Oct 14

## Addendum F: Black Cube Item (Ortec Detective EX100, S/N 7015)

b-Apartment BKG.spc	Background	12 Oct 14
i-Black Cube Ln Tank.spc	Questioned Item	12 Oct 14
k-Known_Th-232.spc	Known Source	12 Oct 14
o-P1000028.JPG	Photo	12 Oct 14
o-P1000029.JPG	Photo	12 Oct 14
o-P1000035.JPG	Photo	12 Oct 14
o-P1000049.JPG	Photo	12 Oct 14
o-P1000051.JPG	Photo	12 Oct 14

## Addendum G: Male Bathroom (Ortec Detective EX100, S/N 7015)

b-Apartment BKG.spc	Background	12 Oct 14
k-Known_Th-232.spc	Known Source	12 Oct 14
i-Male bathroom counter.spc	Questioned Item	12 Oct 14
o-P1000021.JPG	Photo	12 Oct 14
o-P1000022.JPG	Photo	12 Oct 14
o-P1000023.JPG	Photo	12 Oct 14
o-P1000024.JPG	Photo	12 Oct 14

## Addendum H: Female Bathroom (Ortec Detective EX100, S/N 7015)

b-Apartment BKG.spc	Background	12 Oct 14
i-Female Bathroom Counter.spc	Questioned Item	12 Oct 14
k-Known_Th-232.spc	Known Source	12 Oct 14
o-P1000038.JPG	Photo	12 Oct 14

## Addendum I: Male Bedroom Closet (Ortec Detective EX100, S/N 7015)

b-Apartment BKG.spc	Background	12 Oct 14
k-Known_Th-232.spc	Known Source	12 Oct 14
i-Male bedroom closet.spc	Questioned Item	12 Oct 14
o-P1000017.JPG	Photo	12 Oct 14
o-P1000018.JPG	Photo	12 Oct 14
o-P1000019.JPG	Photo	12 Oct 14

## Addendum J: Re-named Photos

Addendum J generated by DOE analysts is a re-named set of photo files; no additional content submitted by the field.

## Addendum K: Kitchen Small Vials (Ortec Detective EX100, S/N 4045)

Apartment BKG.spc	Background	12 Oct 14
2014_10_12_12_19_Known Th Cap.spc	Known Source	12 Oct 14
Kitchen Small Vials.spc	Questioned Item	12 Oct 14
P1000042.JPG	Photo	12 Oct 14
P1000043.JPG	Photo	12 Oct 14
P1000044.JPG	Photo	12 Oct 14

## Addendum L: Liquid Samples (Ortec Detective EX100, S/N 7015)

b-BKG-Samples.spc	Background	13 Oct 14
i-Liquid Samples.spc	Questioned Item	13 Oct 14
o-P1000020.JPG	Photo	12 Oct 14 (Duplicate of Addendum C)
o-20141013_122711.jpg	Photo	13 Oct 14

## Addendum M: Single Small Kitchen Vial (Ortec Detective EX100, S/N 7015)

b-BKG-Samples.spc	Background	13 Oct 14
i-Small Kitchen Vial.spc	Questioned Item	13 Oct 14
o-P1000044.JPG	Photo	12 Oct 14 (Duplicate of Addendum K)

## Addendum N: Sample Cooler Containing All of the Liquid, Powders and Crystals (Ortec Detective EX-100, S/N 4045)

k-Known_Th-232 End Cap.spc	Known Source	22 Oct 14
i-Sample Cooler.spc	Questioned Item	22 Oct 14
b-BKG_EPA_Sample Table.spc	Background	22 Oct 14
o-P1000102.JPG	Photo	22 Oct 14
o-P1000104.JPG	Photo	22 Oct 14

## Addendum O: Yellow Powder Sample (Ortec Detective EX-100, S/N 4045)

b-BKG_EPA_Sample Table.spc	Background	22 Oct 14
k-Known_Th-232 End Cap.spc	Known Source	22 Oct 14
i-Yellow Powder Sample.spc	Questioned Item	22 Oct 14
o-P1000111.JPG.	Photo	22 Oct 14
o-P1000113.JPG	Photo	22 Oct 14

## Addendum P: Orange Powder Sample (Ortec Detective EX-100, S/N 4045)

b-BKG_EPA_Sample Table.spc	Background	22 Oct 14
k-Known_Th-232 End Cap.spc	Known Source	22 Oct 14
i-Orange_Powder_Sample	Questioned Item	22 Oct 14
o-P1000111.JPG.	Photo	22 Oct 14
o-P1000113.JPG	Photo	22 Oct 14

## Addendum Q: Orange Powder Sample (Ortec Detective EX-100, S/N 4045)

b-BKG for Garage 14_ Outside Concrete	Background	22 Oct 14
k-Known_Th-232 End Cap.spc	Known Source	22 Oct 14
i-Male&Female BathroomSink Pea trap	Questioned Item	22 Oct 14
o-bathroom pea traps	Photo	22 Oct 14

## Addendum R: Tupperware Liquid Patio (Ortec Detective EX-100, S/N 4045)

b-Background Outside Garage.spc	Background	22 Oct 14
i-Tupperware_liquid_patio.spc	Questioned Item	22 Oct 14
o-(1) measurement setup.JPG	Photo	22 Oct 14
o-(2) Tupperware liquid.JPG	Photo	22 Oct 14
o-(3)Tupperware liquid.JPG	Photo	22 Oct 14
o-(4)Tupperware Liquid.JPG	Photo	22 Oct 14

## Addendum S: Mo-99 Generator (Ortec Detective EX-100, S/N 4045)

b-Background Outside Garage.spc	Background	22 Oct 14
i-Mo-99 Generator.spc	Questioned Item	22 Oct 14
o-(1) Mo-99 generator column.JPG	Photo	22 Oct 14
o-(2) Distant M0-99.JPG	Photo	22 Oct 14

## Addendum T: Garage (Ortec Detective EX-100, S/N 4045)

b-BKG for Garage 14_ Outside Concrete.spc	Background	22 Oct 14
k-Known_Th-232 End Cap.spc	Known	22 Oct 14
i-Garage 14_C&B Side_ Sector 3.1.spc	Questioned Item	22 Oct 14
i-Garage_14_ D Side_ Sector 1.spc	Questioned Item	22 Oct 14
i-Garage_14_B Side_ Sector 4.spc	Questioned Item	22 Oct 14
i-Garage_14_C Side_ Sector 2.spc	Questioned Item	22 Oct 14
i-Garage_14_C&B Side_ Sector3.2.spc	Questioned Item	22 Oct 14
o-B Side Sector 4.JPG.scaled.JPG	Photo	22 Oct 14
o-B&C side sector 3.JPG	Photo	22 Oct 14
o-C Side Sector 2.JPG	Photo	22 Oct 14
o-D Side Sector 1.JPG	Photo	22 Oct 14
o-Garage Characterization.JPG	Photo	22 Oct 14

## Addendum U: Garage 14 Wall C&D sector, (Ortec Detective EX-100, S/N 4045)

b-(1)BKG_garagefloor#6.spc	Background	24 Oct 14
(3)Garage 14_Wall C_Sector 2.spc	Unknown	24 Oct 14
i-(2)Garage 14_DSide_Sector1.spc	Questioned Item	24 Oct 14
o-Garage 6 Background Friday.JPG	Photo	24 Oct 14
o-Garage 14 C Side Sector 2 Friday.JPG	Photo	24 Oct 14
o-Garage 14 DSide Sector 1 Friday.JPG	Photo	24 Oct 14
o-Garage Characterization.JPG	Photo	22 Oct 14

## Addendum V: Garage 14 Side D (Ortec Detective EX-100, S/N 4045)

b-Sat_Outside_Garage 14_BKG.spc	Background	25 Oct 14
k-Sat_Known_Th_232 End CaP.spc	Known	25 Oct 14
i-Sat_Side D Sector 1.a.spc	Questioned Item	25 Oct 14
i-Sat_Side D Sector 2.b.spc	Questioned Item	25 Oct 14
o-(1)Sat_Garage14_DSide Sector 1.JPG	Photo	25 Oct 14
o-(2) Am241 sources.JPG	Photo	25 Oct 14
o-(3) Sat_Garage14_DSide_Sector2.JPG	Photo	25 Oct 14

## Addendum W: Prescription Bottle (Be Oxide) With Am-241 Source (Ortec Detective EX-100, S/N 4045)

b-BKG_Outdoor_Garage.spc	Background	24 Oct 14
i-Garage 14_Presbottle_Marked Be.spc	Questioned Item	24 Oct 14
o-(1)Prescription Bottles (Am241).JPG	Photo	24 Oct 14
o-(2)Orange_Prescription Bottle (Am241).JPG	Photo	24 Oct 14
o-(3) Orange Prescription Bottle Closeup.JPG	Photo	24 Oct 14
o-(4) Garage 14 DWall.JPG	Photo	24 Oct 14
o-(5) Location of Prescription Bottles on D Wall.JPG	Photo	24 Oct 14

## Addendum X: Identical Files to Addendum W

## Addendum Y: Identical Files to Addendum W

## Addendum Z: Prescription Bottle (Co&Be Oxide) With Am-241 Source(Ortec Detective EX-100, S/N 4045)

b-BKG_Outdoor_Garage.spc	Background	24 Oct 14
i-Garage 14_Prescbottle 2_marked Co&Be.spc	Questioned Item	24 Oct 14
o-(1)Prescription Bottles (Am241).JPG	Photo	24 Oct 14
o-(2) Yellow Prescription Bottle (Am241).JPG	Photo	24 Oct 14
o-(3) Closeup Yellow prescription bottle.JPG	Photo	24 Oct 14

## Addendum AA: Radium Clock Face Plate (Ortec Detective EX-100, S/N 4045)

b-BKG_Outdoor_Garage.spc	Background	24 Oct 14
i-Radium ClockFace Piece.spc	Questioned Item	24 Oct 14
o-(1) Radium clock face plate.JPG	Photo	24 Oct 14
o-(2) Radium clock face plate.JPG	Photo	24 Oct 14
o-(3) Radium Clock face plate.JPG	Photo	24 Oct 14
o-(4) Radium clocks in apartment.JPG	Photo	24 Oct 14

## Addendum AB: Radium Clock Garage (Ortec Detective EX-100, S/N 4045)

b-Garage6_BKG_WhiteBox.spc	Background	24 Oct 14
i-Garage 6_RaClock.spc	Questioned Item	24 Oct 14
o-(1) Garage #6.JPG	Photo	24 Oct 14
o-(2) Radium Clock measurement.JPG	Photo	24 Oct 14
o-(3) radium sources_malebedroom.JPG	Photo	8 Oct 14

## Addendum AC: Revigator (Ortec Detective EX-100, S/N 4045)

b-BKG_Outdoor_Garage.spc	Background	24 Oct 14
i-Ra_Revigator.spc	Questioned Item	24 Oct 14
o-(1) radium revigator.JPG	Photo	24 Oct 14
o-(2) radium revigaotr .JPG	Photo	24 Oct 14
o-(3) B&C side sector 3.JPG	Photo	24 Oct 14
o-(4) radium revigator.JPG	Photo	24 Oct 14

## Addendum AD: Garage Am-241 Sources (Ortec Detective EX-100, S/N 4045)

b-BKG_Outdoor_Garage.spc	Background	24 Oct 14
i-Garage 14_Am-241 Sources.spc	Questioned Item	24 Oct 14
o-(1) Composite Am241.JPG	Photo	24 Oct 14
o-(2) Am241 Composite measurement.JPG	Photo	24 Oct 14
o-(3) Radioscope (Am241) Front.JPG	Photo	24 Oct 14
o-(4) Radioscope(Am241)back.JPG	Photo	24 Oct 14
o-(5) Second Radioscope (noAm241).JPG	Photo	24 Oct 14
o-(10) Am241 cone b.JPG	Photo	24 Oct 14
o-(11) More solid Am241 sources.JPG	Photo	24 Oct 14

## Addendum AE: Garage Smoke Detector Boards (Ortec Detective EX-100, S/N 4045)

b-Outside Background_tree.spc	Background	25 Oct 14
k-Sat_Known_Th_232 End CaP.spc	Known	25 Oct 14
i-Garage 14 SmokeDetector Boards.spc	Questioned Item	25 Oct 14
o-(1) Garage 14_DWall_Sector 1_Location (Am241)Sat.JPG	Photo	25 Oct 14
o-(2) Am241 sources.JPG	Photo	25 Oct 14
o-(3) Side view_Am241 Sat.JPG	Photo	25 Oct 14

### **ADDITIONAL INFORMATION**

On the bridgeline, RAP team members identified that the Addendum A chemical container may not be an actual lead pig, and rather a standard medical isotope storage container without lead shielding present. It was confirmed that both field instruments in use are Ortec Detective EX100 models (S/N 4045 and 7015).

Throughout the event we received useful photographs and descriptions that provided good situational awareness.

## TECHNICAL ASSESSMENT

Triage analyzed TE-14-2148 unknown spectra using Peak Easy Versions 4.60 and 4.74, GADRAS 18.4.3, and Gamma Designer 3.11.4.

**TABLE 1: RADIONUCLIDE(S) IDENTIFIED**

Item	Radionuclide(s)	Quantity	Remarks
<b>TE-14-2148 Main</b> i-Lead Pig(long count).spc Distance = 10 cm	Natural or depleted uranium	100-150 grams of uranium	Spectrum is consistent with either natural or depleted uranium, chemically separated > 90 days prior; fitting is more consistent with metal form (see Addendums C/F)
<b>Addendum A</b> i-Soltas Car Trunk Item of Interest.spc Distance = N/A	Weakly elevated U-235/U-238	N/A, inconsistent with kilogram quantities	Weakly elevated U-238 and U-235, consistent with chemically separated uranium.
<b>Addendum B</b> o-IMG_2030 (1).jpg Distance = N/A	Field RIID Report: Elevated DU from U-235/U-238	N/A	Field IdentiFinder reported elevated DU from U-235/U-238, spectrum file is not available; any possible DU item is not determined in the photo field of view.
<b>Addendum C</b> i-Black Cube Bathroom.spc Distance = 20 cm	Depleted uranium metal	400-800 grams	Spectrum modeling is consistent with depleted uranium metal.
<b>Addendum D</b> i-Outdoor Patio Powder.spc Distance = 15 cm	Uranium oxide powder	< Few grams (rough)	Spectrum content is equally consistent with natural or depleted uranium, chemically separated > 90 days prior; oxide form is presumed from photo image.
<b>Addendum E</b> i-Male Bedroom.spc Distance = 100 cm (roughly)	Uranium ore	N/A	Natural uranium ore daughters of U-238 are present in appropriate equilibrium; no evidence of chemical processing; item of interest identified as a legacy "Revigator". See also Addendum AC.
<b>Addendum F</b> i-Black Cube Ln Tank.spc Distance = 18 cm	Depleted uranium metal	100-300 grams	Spectrum modeling is consistent with depleted uranium metal.
<b>Addendum G</b> i-Male bathroom counter.spc Distance = 43 cm	Natural uranium oxide powder	50-100 grams (rough)	Spectrum content is consistent with natural uranium, chemically processed > 90 days prior; oxide form is presumed from photo image.
<b>Addendum H</b> i-Female Bathroom Counter.spc Distance = 14 cm	Natural uranium oxide powder	5-20 grams (rough)	Spectrum content is consistent with natural uranium, chemically processed > 90 days prior; oxide form is presumed from photo image.
<b>Addendum I</b> i-Male bedroom closet.spc Distance = 61 cm	Uranium ore Thorium ore Americium-241	N/A	Uranium ore and thorium ore chains are strongly present in appropriate equilibrium (no evidence of chemical processing); Am-241 is observed w/ low attenuation, consistent with the partially dismantled commercial smoke detector seen in photos.

(Cont.)



# TRIAGE EVENT NUMBER: TE-14-2148-A REV 6.1 (ACTUAL)

Item	Radionuclide(s)	Quantity	Remarks
<b>Addendum K</b> Kitchen Small Vials.spc Distance = 12.7 cm	Natural uranium, oxide or solution	< Few grams	Spectrum is consistent with natural uranium, chemically processed > 90 days prior; non-metal form from fitting.
<b>Addendum L</b> Liquid Samples.spc Distance = 15.4 cm	Natural uranium solution	< Few grams	Spectrum is consistent with natural uranium, chemically processed > 90 days prior; likely in solution of weak or strong inorganic nitric/sulfuric/hydrochloric acid.
<b>Addendum M</b> Small Kitchen Vial.spc Distance = 6.9 cm	Natural uranium oxide (powder)	< 1 gram	Spectrum is consistent with natural uranium, chemically processed > 90 days prior; in oxide powder form.
<b>Addendum N</b> Sample Cooler.spc Distance = 48.3	Natural or depleted uranium	15-60 grams	A plastic cooler of all liquids, powders, and crystals that EPA is preparing to send out for laboratory analysis. Spectrum is consistent with either natural or depleted uranium, chemically separated > 90 days prior.
<b>Addendum O</b> Yellow_Powder Sample.spc Distance = 15.2 cm	Natural or depleted uranium	10 to 20 grams	Yellow Powder collected from bowl and cups from the cabinet above the toilet from the Male's bathroom on 12 Oct 2014. Spectrum is consistent with either natural or depleted uranium oxide, chemically separated > 90 days prior. See photo o-P1000111.JPG.
<b>Addendum P</b> Orange_Powder_Sample.spc Distance = 15.2 cm	Natural or depleted uranium	10 to 20 grams	Orange material which had a consistency of the thick-dried paint. Spectrum is consistent with either natural or depleted uranium oxide, chemically separated > 90 days prior. See photo o-P1000024.JPG (red cup)
<b>Addendum Q</b> Male&Female BathroomSink Pea traps.spc Distance = 20.3 cm	Background	Background	The bathroom sink pea traps from both the male and female's bathroom. Spectrum is consistent with background.
<b>Addendum R</b> Tupperware_liquid_patio.spc Distance = 30.5 cm	Depleted uranium	100 – 300 grams	Analysis indicates depleted uranium is more consistent than natural. Uranium metal and certain oxides are soluble in inorganic acids such as nitric, sulfuric, or hydrochloric (while insoluble in water).
<b>Addendum S</b> i-Mo-99 Generator.spc Distance = 7.6 cm	Sb-125	< 1 micro Curie	Analysis indicates the presence of Sb-125 fission product, as a trace secondary fission product in Mo-99/Tc-99m medical isotope cows. Other possible trace fission products such as Ru-103 or Ru-106 were not observed.
<b>Addendum T</b> Garage 14_C&B Side_Sector 3.1.spc Distance = 40.6 cm	Am-241 Present	N/A	Requested to verify presence or absence of Am-241 in the spectrum
<b>Addendum T</b> Garage_14_B Side_Sector 4.spc Distance = 45.7 cm	Am-241 not present	N/A	Requested to verify presence or absence of Am-241 in the spectrum
<b>Addendum T</b> Garage_14_C Side_Sector 2.spc	Smaller amount of Am-241 present	N/A	Requested to verify presence or absence of Am-241 in the spectrum



# TRIAGE EVENT NUMBER: TE-14-2148-A REV 6.1 (ACTUAL)

Item	Radionuclide(s)	Quantity	Remarks
<b>Addendum T</b> Garage_14_C&B Side_Sector3.2.spc Distance = 40.6 cm	Am-241 not present	N/A	Requested to verify presence or absence of Am-241 in the spectrum
<b>Addendum T</b> Garage_14_D Side_Sector 1.spc Distance = 91.4 cm	Am-241 Present	N/A	Requested to verify presence or absence of Am-241 in the spectrum
<b>Addendum U</b> Garage 14_Wall C_Sector 2.spc Distance = Not Given	No Am-241	N/A	Requested to verify presence or absence of Am-241 in the spectrum
<b>Addendum U</b> Garage 14_DSide_Sector1.spc Distance = 40.6 cm	Small amount of Am-241 is present	N/A	Requested to verify presence or absence of Am-241 in the spectrum
<b>Addendum V</b> Garage Side D Sector 1.a.spc (Saturday) Distance = 48.2 cm	No Am-241	N/A	Requested to verify presence or absence of Am-241 in the spectrum
<b>Addendum V</b> Garage Side D Sector 2.b.spc (Saturday) Distance = 30.5 cm	No Am-241	N/A	Requested to verify presence or absence of Am-241 in the spectrum
<b>Addendum W</b> Prescription bottle with Am-241 source.spc Distance = 12.7 cm	Am-241	< 1 micro Curie	Requested to verify presence or absence of Am-241 in the spectrum
<b>Addendum X</b>	Duplicate of W	Same as above	Thick client submitted duplicate W data
<b>Addendum Y</b>	Duplicate of W	Same as above	Thick client submitted duplicate W data
<b>Addendum Z</b> i-Garage 14_Prescbottle 2_marked Co&Be.spc Distance = 12.7 cm	Am-241	Fraction of micro Curie	Requested to verify presence or absence of Am-241 in the spectrum
<b>Addendum AA</b> Radium ClockFace Piece.spc Distance = 15.24 cm	Ra-226 and progeny	0.05 – 0.1 micro Ci	Radium clock face piece.
<b>Addendum AB</b> Garage 6_RaClock.spc Distance = 15.24 cm	Ra-226 and progeny	0.18 – 0.3 micro Ci	Garage radium clock.
<b>Addendum AC</b> Ra_Revigator.spc Distance = 63.5 cm	U Oxide	30 – 60 grams of Natural Uranium	Revigator legacy item, properly UO <sub>2</sub> in a ceramic matrix, see also Addendum E.
<b>Addendum AD</b> Garage 14_Am-241 Sources.spc Distance = 25.4 cm	Am-241	10 – 20 micro Ci	Am-241 sources collected in a plastic bucket, segregated for EPA disposition.
<b>Addendum AE</b> i-Garage 14 SmokeDetector Boards.spc Distance = 15.24 cm	Am-241	5 – 10 micro Ci	Garage 14, collection of Am-241 smoke detector electronic boards, segregated for EPA disposition.

## TE-14-2148 Main – Chemical Container

Triage identified U-235 (186 keV) and U-238 (766, 1001 keV) strongly elevated over background. With gamma spectrum modeling for the Detective EX100, the uranium was assessed to be consistent with either natural or depleted uranium. The physical form is consistent with metal uranium, with strong similarities to Addendum C and F items received later.

The spectrum is consistent with chemically separated uranium, as decay-chain daughters present in uranium ore are strongly reduced in the unknown (Th-230/Ra-226 daughters for U-238; Th-228 daughters for Th-232).

The spectrum shows lower-energy lines from uranium, including Th-234 (92 keV) and strong uranium x-ray fluorescence lines from 93-115 keV. These observations are consistent with only weak external shielding of the uranium, if any. Triage analysts found uranium self-attenuation alone gave consistent fitting results, and that introducing external shielding, as if from a lead pig, was not consistent with the observed spectrum. It is possible the container holds depleted uranium metal similar to Addendums C/F, together with other material forms such as oxide powder. (See Figures 1, 2, and 3.)

The approach used in estimating uranium isotopic composition assumes the material was last chemically separated more than 90 days prior. The Pa-234m daughter lines (766, 1001 keV) are used to assay U-238, and the intermediate Th-234 has half-life of 24 days. This is a conservative assumption, in that were the material separated more recently than 90 days, it would actually be depleted in U-235 and giving the appearance of natural uranium. Also, since Th-234/Pa-234/Pa-234m daughters are strongly evident, the material must be aged more than some 2-4 weeks to have allowed their in-growth.

From spectrum modeling, Triage assesses the quantity of natural uranium to be 100-150 grams uranium, natural or depleted, with the range caused by undetermined physical form and density of both the uranium material and intervening shielding. If the chemical container is determined to have lead shielding, the estimated uranium quantity would increase.

### **Addendum A: 1st Car Trunk Flooring**

Triage assesses the unknown spectrum shows moderate evidence for U-238 elevated over background, and evidence of more weakly elevated U-235. The data quality is not sufficient to estimate uranium isotopic composition on the flooring. The contamination is consistent with chemically-separated natural or depleted uranium, and inconsistent with either highly-enriched uranium or natural uranium ore. (See Figures 4 and 5.)

The spectrum shows evidence of the Th-234 daughter (92 keV line) of U-238, consistent with a lightly shielded unknown as the case for surface contamination. The data are not consistent with kilogram quantities of uranium, and are consistent with surface contamination levels. Performing a gamma assay in the confines of a vehicle trunk causes local background suppression by the vehicle body, which modeling has accounted for. Analysts also noted a potential gamma peak near 662 keV, which is not present in the associated background. This may reflect either the weak presence of Cs-137 in the trunk contamination, or possibly bleed-through from a nearby check source in use by the field team.

While an assessment of uranium isotopics is inconclusive given the available data, additional HPGe spectra in the setting of the vehicle trunk would likely not improve the ability of Triage to assess uranium isotopics.

### **Addendum B: 2nd Private Vehicle Trunk (Photo Only)**

For this location, Boise Fire Department responders collected an Identifinder spectrum on 8 Oct from the trunk of a 2<sup>nd</sup> personal vehicle. The submitted photo shows the context of the trunk assay; the image does not include the Identifinder instrument or any screenshot of the RIID output reported to assert "Depleted Uranium." Obtaining the Identifinder gamma spectrum collected 8 Oct 2014 would allow Triage to contribute a radiological assessment (or less useful, would be a handheld screen capture). (See Figure 6.)

It is not clear what actual item in the Identifinder field-of-view caused the field RIID identification of "depleted uranium"; the item may be obscured in the photo. The paper scrap in the photo refers to Boise Metal Works, and implies some sort of procurement may have occurred; further details are obscured in the image. Online review of the Boise Metal Works website does not immediately indicate sales of "depleted uranium", although possible. Inquiring with the involved parties would seem in order, about contents of the 2nd vehicle and any possible procurements. Physical inspection of the 2<sup>nd</sup> vehicle trunk contents appears needed to resolve whether a depleted uranium item is present.

### **Addendum C: Black Cube Item (Ortec Detective EX100, S/N 4045)**

Depleted uranium metal object, from Triage spectrum modeling estimated at 400-800 grams. Modeling results are more consistent with depleted uranium metal than with natural uranium, in checking the U-235 (186 keV) line intensity. Overall quality of modeling fit to the spectrum is good. (See Figures 7 and 8.)

## **Addendum D: Outdoor Black Powder (Ortec Detective EX100, S/N 4045)**

Unknown spectrum collected against “black powder” dispersed on patio surface and found to give elevated count rate in beta/gamma survey. From spectrum modeling, uranium oxide powder quantity is estimated at < a few grams, as a rough estimate given the irregular source geometry. Spectrum content is equally consistent with natural or depleted uranium. The spectrum is consistent with chemically separated uranium, without elevated Ra-226 and daughters present. The assessment of natural/depleted uranium has the conservative assumption of last chemical separation > 90 days prior. There are chemical forms of uranium oxide consistent with the “black powder” shown in the image. (See Figures 9 and 10.)

## **Addendum E: Male Bedroom (Ortec Detective EX100, S/N 4045)**

Strongly elevated natural uranium ore, with natural U-238 daughters present in quantitative equilibrium, including Th-234, Pa-234, Pa-234m, Th-230, and Ra-226 with daughters. This indicates natural uranium ore without chemical processing.

The foreground item in the photo is an archaic “Revigator,” fabricated with the mineral carnotite. This mineral has natural UO<sub>2</sub> bound in its mineral composition, and was used to infuse water with radon and its daughters. (See Figures 11 and 12; also, [http://en.wikipedia.org/wiki/Radium\\_Ore\\_Revigator](http://en.wikipedia.org/wiki/Radium_Ore_Revigator) and <http://en.wikipedia.org/wiki/Carnotite>.) Also, Addendum AC.

## **Addendum F: Black Cube Item (Ortec Detective EX100, S/N 7015)**

Depleted uranium metal object, from Triage spectrum modeling estimated at 100-300 grams. Modeling results are more consistent with depleted uranium metal than with natural uranium, in comparing the modeled U-235 (186 keV) line intensity for the two possibilities. Overall quality of modeling fit to the spectrum is good. (See Figures 13 and 14.)

## **Addendum G: Male Bathroom (Ortec Detective EX100, S/N 7015)**

Observed “chemical compound powder” with measured distance to detector. From spectrum modeling, the material is consistent with natural uranium oxide powder, with quantity roughly estimated at 50-100 grams. Remaining comments are identical to those for Addendum D. (See Figures 15 and 16.)

## **Addendum H: Female Bathroom (Ortec Detective EX100, S/N 7015)**

Observed “chemical compound powder” with measured distance to detector. From spectrum modeling, the material is consistent with natural uranium oxide powder, with quantity roughly estimated at 5-12 grams. Remaining comments are identical to those for Addendum D. (See Figures 17 and 18.)

## **Addendum I: Male Bedroom Closet (Ortec Detective EX100, S/N 7015)**

Elevated natural uranium ore and thorium ore, as one or more undetermined objects present in the HPGe field of view. Natural U-238 daughters are present in appropriate equilibrium, including Th-234, Pa-234, Pa-234m, Th-230, and Ra-226 with daughters. Natural Th-232 decay-chain daughters are also present in equilibrium, whether in a specific individual item, or in combination with the natural uranium ore. This indicates natural uranium and thorium without chemical processing having occurred, including. (See Figures 19 and 20.)

Significantly, Americium-241 (59 keV) is detected in this unknown spectrum, not observed in other unknowns. Examining photo *P1000018.JPG*, the middle shelf shows a partially dismantled smoke detector. The imbedded Am-241 source has not yet been fully exposed. While the observed Am-241 quantity cannot be estimated given the undetermined source-detector distance, a lightly shielded Am-241 source is consistent with the observed spectrum. (See Figures 21 and 22.)

## **Addendum J:**

Addendum J generated by DOE analysts is a re-named set of photo files; no additional content submitted by the field.

## **Addendum K: Kitchen Small Vials (Ortec Detective EX100, S/N 4045) – Email Submission 16 Oct 2014**

From spectrum modeling, natural uranium with quantity estimated < a few grams, as a rough estimate given the irregular source geometry across vials. Spectrum content is consistent with natural uranium, chemically separated > 90 days prior. There are chemical forms of uranium oxide consistent with the white and yellow powders shown. (See Figures 23 and 24.)

## **Addendum L: Bathroom Liquid Samples (Ortec Detective EX100, S/N 7015)**

From spectrum modeling and fitting, natural uranium of quantity < a few grams total, as a rough estimate given the irregular sample geometry. The spectrum is consistent with natural uranium in solution, chemically separated > 90 days prior. Emissions from Th-234 lower-energy gamma rays are evident, while U x-ray fluorescence lines seen in other spectra are relatively reduced, allowing analysts to distinguish between solution versus metal or oxide solid forms. (See Figures 25 and 26.)

While insoluble in water alone, uranium metal and certain oxides are soluble in acid solutions:  $U_3O_8$  and  $UO_3$  are soluble in nitric, sulfuric, or hydrochloric acids, while  $UO_2$  is not. It is reasonable to expect these "liquid samples" may be dilute or strong inorganic acid solutions; nevertheless, inorganic acid solutions can be modeled as mainly water unless highly concentrated.

## **Addendum M: Small Kitchen Vial (Ortec Detective EX100, S/N 7015)**

From spectrum modeling, natural uranium with quantity estimated < 1 gram, as a rough estimate given the irregular source geometry of the powder. Spectrum content is consistent with natural uranium, chemically separated > 90 days prior. There are uranium oxide chemical forms consistent with the white/yellow powder shown. (See Figures 27 and 28.)

## **Addendum N: Sample Cooler Containing All of the Liquid, Powders and Crystals (Ortec Det EX-100, S/N 4045)**

That total material quantity is estimated to be consistent with 15-60 grams of processed natural or depleted uranium. The assessment of natural/depleted uranium has the conservative assumption of last chemical separation > 90 days prior.

The source to detector distance for Addendum N was 48.3 cm. For a SimpleMass.xls calculation following assumption were used: Cooler thickness was 5mm of poly, the cooler width is 12 inches (30.5 cm) front to back and the uranium is in equilibrium with Th-234 and Pa-234m, The 92.6 keV doublet was used to estimate self-attenuation after compensation for attenuation effects of the cooler. Simple Mass gave the estimated mass of the sample to be 34 grams of depleted uranium (See Figure #30). The range of 15-60 grams reflects the undetermined depth of items within the container.

## **Addendum O: Yellow Powder Sample (Ortec Detective EX-100, S/N 4045)**

This item is consistent with a natural or depleted uranium oxide sample of 10-20 grams, again by Simple Mass. The assessment of natural/depleted uranium has the conservative assumption of last chemical separation > 90 days prior. (See Figure #31)

## **Addendum P: Orange Powder Sample (Ortec Detective EX-100, S/N 4045)**

This item is consistent with a natural or depleted uranium oxide sample of 10-20 grams, again by Simple Mass. The assessment of natural/depleted uranium has the conservative assumption of last chemical separation > 90 days prior.

## **Addendum Q: Bathroom Pea Trap Sample (Ortec Detective EX-100, S/N 4045)**

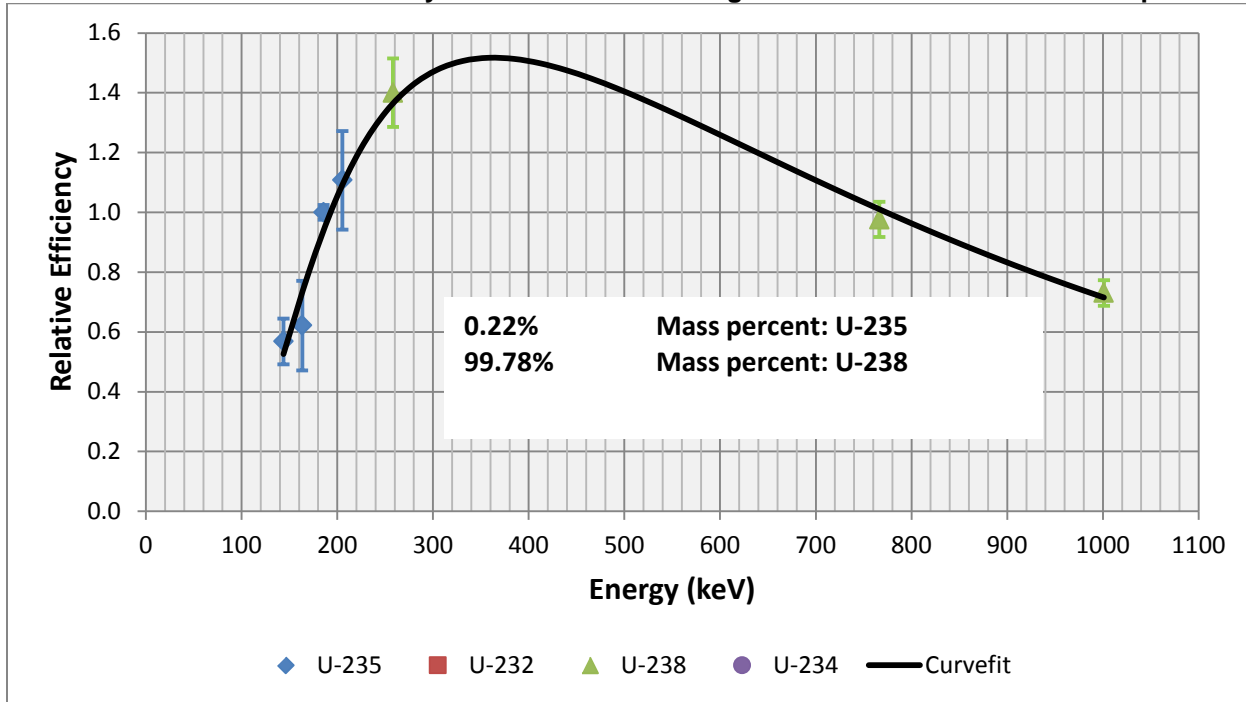
This spectrum was consistent with a background spectrum.

## **Addendum R: Tupperware Liquid Patio (Ortec Detective EX-100, S/N 4045)**

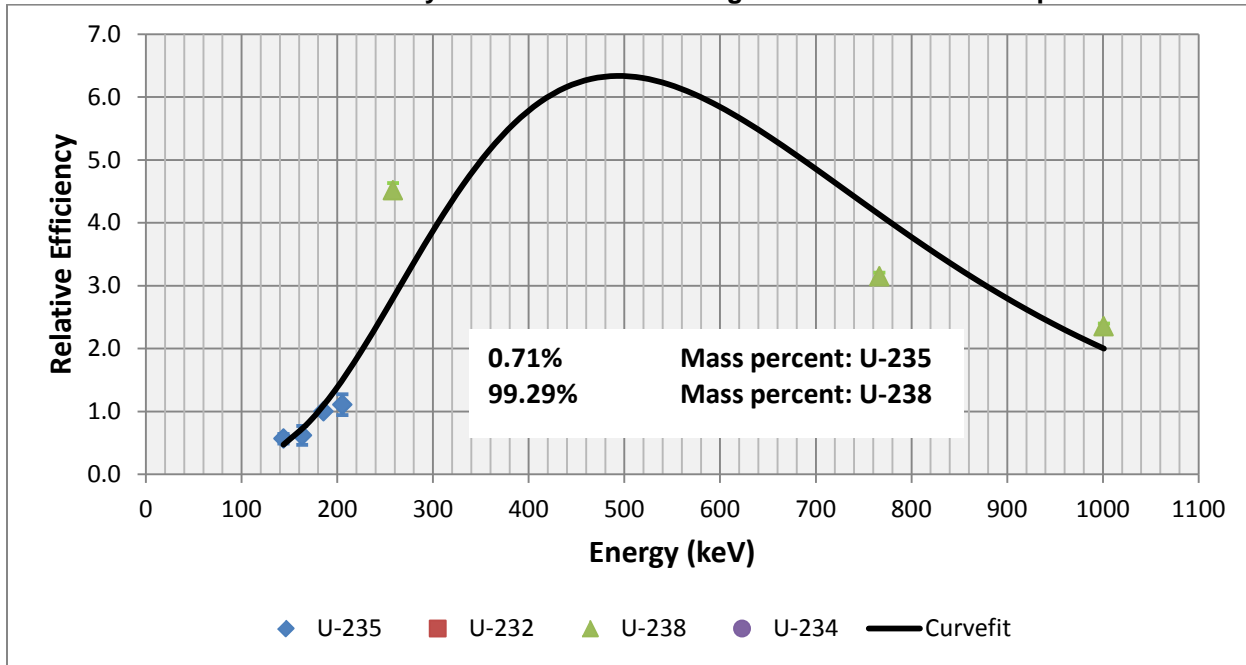
This sample was in a flat and square Tupperware container (9" x 9" x 4.5") or (22.9 x 22.9 x 11.4 cm) that weighed 4 lbs (1.8 kg) with its solution contents. The measurement set-up is shown in Figure #32, and the container itself in Figure #33. The Tupperware spectrum was consistent with 100 to 300 grams of depleted uranium in liquid solution. Uranium oxides  $U_3O_8$  and  $UO_2$  are soluble in nitric acid up to ~ 600 grams of uranium/liter; making the assay plausible. Details of one analysis are given below; other independent analyses using SimpleMass.xls and GADRAS gave similar results. The assessment of uranium composition makes the conservative assumption of last chemical separation > 90 days prior.

Due to the 258.3 keV peak having good counting statistics, a relative efficiency curve fit was able to be generated which indicated results are consistent with the presence of depleted uranium. The minimum mass of 100 grams was calculated using the measured peak areas at 1001, 1738, and 1832 keV and conservatively assuming all of the activity was present at the front of the container without attenuation.

Addendum R: A relative efficiency curve fit demonstrating the data are consistent with depleted uranium.



Addendum R: A relative efficiency curve fit demonstrating a natural uranium composition is less consistent.



## **Addendum S: Mo-99 Generator (Ortec Detective EX-100, S/N 4045)**

In this spectrum, analysts identified Sb-125 (half-life = 2.3 yrs). In Mo-99 production, the trace secondary fission product of Sb-125 is expected to varying degrees. SimpleMass.xls gave a fraction of a microCurie of Sb-125, strongly shielded.

When Mo-99 is produced as a fission product, the eluate also has radionuclides such as Ru-103, Ru-106, Sb-125 and I-131. Standard references indicate that even after a year of storage for Tc-99m/Mo-99 spent generators, activity levels of Ru-103, Ru-106 and Sb-125 trace fission products may be present. Even after 10 years of storage, generator disposal can be complicated due to residual Sb-125 activity. (Ru-103, Ru-106, I-131 were not identified in this spectrum.)

## **Addendum T: Garage (Ortec Detective EX-100, S/N 4045)**

We were asked to confirm presence or absence of Am-241 in multiple spectra collected from Garage #14. Table 1 lists individual spectrum results from Addendum T. Am-241 was identified in Sectors 1, 2, 3.1, and 4; no Am-241 was observed in Sector 3.2. The C-side Sector 2 spectrum file is shown as an example in Figure #35. We note the confined quarters of the garage could potentially cause gammas from Am-241 sources present in one area to bleed across sectors.

## **Addendum U: Garage C and D sectors (Ortec Detective EX-100, S/N 4045)**

We were asked to confirm presence or absence of Am-241 in sector C and sector D from Garage #14. Sector C did not have any Am-241 signature, while the sector D spectrum did have Am-241. Same comment as Addendum T.

## **Addendum V: Garage Sector D 1.a and 2.b (Ortec Detective EX-100, S/N 4045)**

We were asked to confirm presence or absence of Am-241 in the two sector D spectra. No Am-241 was found in these two spectra.

## **Addendum W: Prescription Bottle (labeled Be Oxide) with Am-241 source inside (Ortec Det EX-100, S/N 4045)**

By 1D point source modeling, our analysis indicates < 1 uCi worth of Am-241 in the spectrum.

**Addendum X and Y:** These addendums duplicate Addendum W.

## **Addendum Z: Prescription bottles (Labeled Co + Be) with Am-241 sources (Ortec Detective EX-100, S/N 4045)**

By 1D point-source modeling, our analysis indicates Am-241 with a quantity < 1 uCi.

## **Addendum AA: Radium Clock Face Plate**

By 1D point-source modeling, contains 0.05-0.1 micro Curies of Ra-226 and daughters, no other nuclides are present. This quantity is consistent with known radium watch dial levels. (See Figure #36.)

## **Addendum AB: Radium Clock Garage**

By 1D point-source modeling, contains 0.2-0.3 micro Curies of Ra-226 and daughters, no other nuclides are present.

## **Addendum AC: Revigator**

Source-detector modeling of the Revigator as a 1D spherical concrete shell gave results consistent with 30-60 grams of natural uranium oxide, imbedded in the ceramic matrix. A fit to the data is shown in Figure #37. Also, see Addendum E.

## **Addendum AD: Garage Am-241 Sources**

By 1D point-source modeling, contains roughly 10-20 micro Curie of Am-241.

## **Addendum AE: Garage Smoke Detector Boards**

By 1D point-source modeling, contains roughly 5-10 micro Curie of Am-241



## REMARKS

Submitted gamma spectrum files and photos were of good quality, spectrum file renaming was helpful to analysts.

## SITUATIONAL ASSESSMENT

As conveyed by bridgeline to Triage, statements of the Idaho individuals involved indicated intentional efforts to perform chemical processing to produce separated uranium.

In the location photos overall, Triage notes no industrial processing equipment of the type and scale necessary to chemically extract natural uranium from ore, then produce chemically purified uranium oxide compounds. Any indicative waste streams of separated daughters are also absent; waste streams are commonly observed to be out of equilibrium, given differences in chemistry among elements. Furthermore, producing 100s of grams of natural uranium oxide entails some 10s to 100s of kilograms of natural uranium ore.

Triage assesses it more likely that commercial purchases were made of natural uranium oxide in purified chemical compounds and depleted uranium items, which are both available in legitimate transactions.

Document "o-Photo Log – [Boise] apartment" included photographs of a benchtop fusion demonstration apparatus (Photographs 1, 2), a legacy Revigator (photograph 24), mineral rocks (photograph 69), Tc-99m/Mo-99 generator (photograph 70), and uranium glass (photograph 76) among other things.

Photograph 25 from the "Photo Log" shows items from Male's bedroom. This photograph shows a bubble detector with bubbles in the detector. Some clocks are also seen in the photograph. In Addendum AB, the same photograph was sent as "o-(3) radium sources\_malebedroom.JPG". (See Figure #29).

## TRIAGE RECOMMENDATIONS

### NEXT STEPS

Items through Addendum M are fully resolved; further information from physical examination of container materials and thicknesses might cause Triage to re-evaluate uranium quantities and possibly isotopic compositions.

Triage analysts noted other photos indicating items with possible radiological uses and exposures. As field responders address the full contents of the residence, Triage analysts may be able to contribute further assessments. For instance, note was taken of: a neutron bubble dosimeter showing evidence of past neutron exposure, components of a potentially viable benchtop fusion apparatus, a commercial vacuum pump, and electronic circuitry including capacitors.

Triage notes the potential for federal and state regulatory guidelines to apply to such chemical and radiological materials.

### RADIOLOGICAL HEALTH/SAFETY

Depleted uranium metal, natural uranium ore, and chemically-processed natural uranium oxide pose minimal risk to health and safety; ingestion or inhalation hazards may be present, depending on level of exposure. The presence of Am-241 and Ra-226 noted for several Addendums could pose alpha contamination hazards, depending on the degree of smoke detector dismantlement and watch dial leakage.

We note the "liquid samples" of Addendums L and R, in particular, are potentially dilute or strong inorganic acid solutions, plausibly from dissolving natural uranium oxides of  $U_3O_8$  or  $UO_3$  (or depleted uranium metal) in an acid such as nitric, sulfuric, or hydrochloric.

See IAEA Radiation Safety Guide RS-G-1.9 (2005), Table 3, discussion for "Category of Source – 5".

### PROCESS IMPROVEMENTS

None.



## FIGURES AND TABLES



Figure #1: TE-14-2148 Main, Chemical Container, gamma assay configuration with Detective EX100.

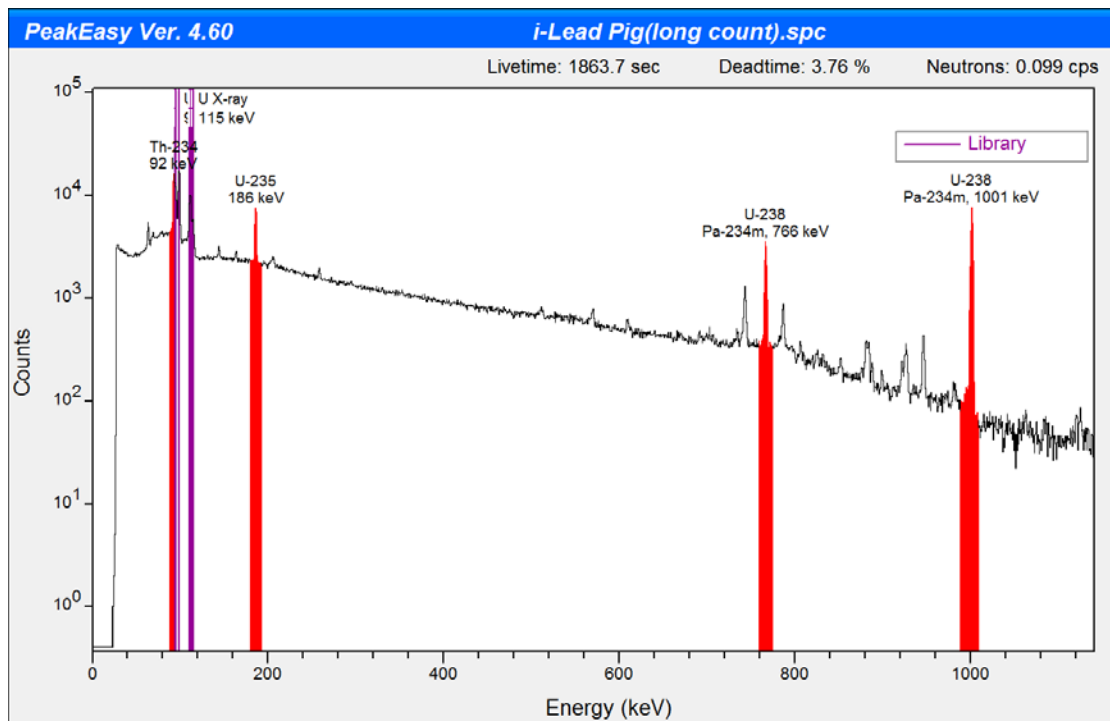
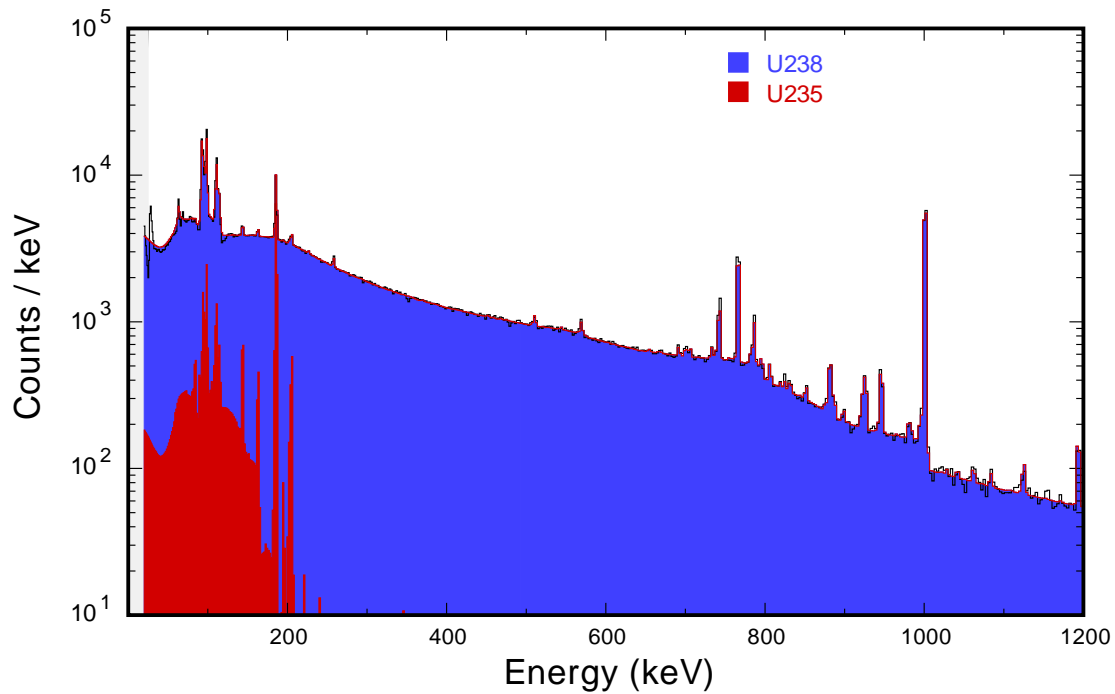


Figure #2: TE-14-2148 Main, Chemical Container, screenshot showing elevated U-235/U-238 with either natural or depleted uranium composition, and the absence of Ra-226 daughters from U-238, discussed further in the text.

TE-14-2148.pcf,2<TE-14-2148.pcf,1

live-time(s) = 1864

chi-square = 0.40



**Figure #3: TE-14-2148 Main, Chemical Container, Triage spectrum fitting results showing the quality of fit for natural uranium composition with uranium metal self-attenuation only (no external lead pig).**



**Figure #4: TE-14-2148 Addendum A, Car Trunk Flooring, showing elevated beta-gamma count rate of 2200 cpm.**

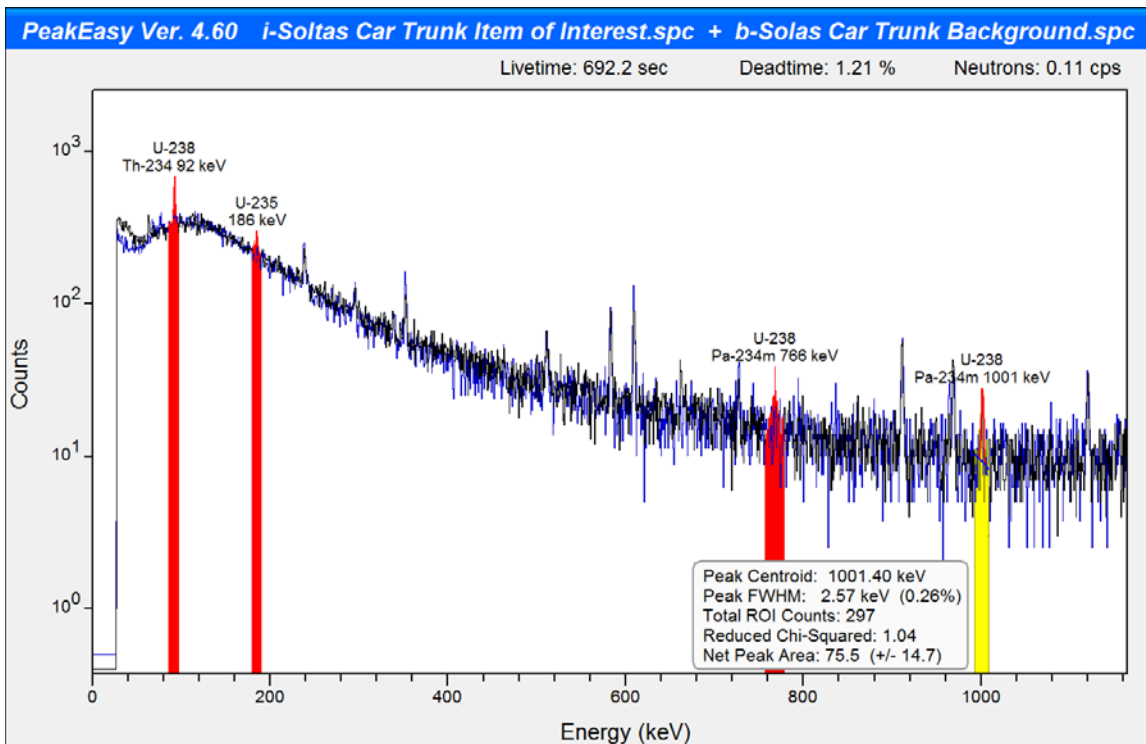


Figure #5: TE-14-2148 Addendum A, Car Trunk Flooring, screen capture show weak elevation of U-235 and U-238 over background, discussed further in the text.



Figure #6: TE-14-2148 Addendum B, 2<sup>nd</sup> Vehicle Trunk (Photo Only), screen capture show weak elevation of U-235 and U-238 over background, discussed further in the text.



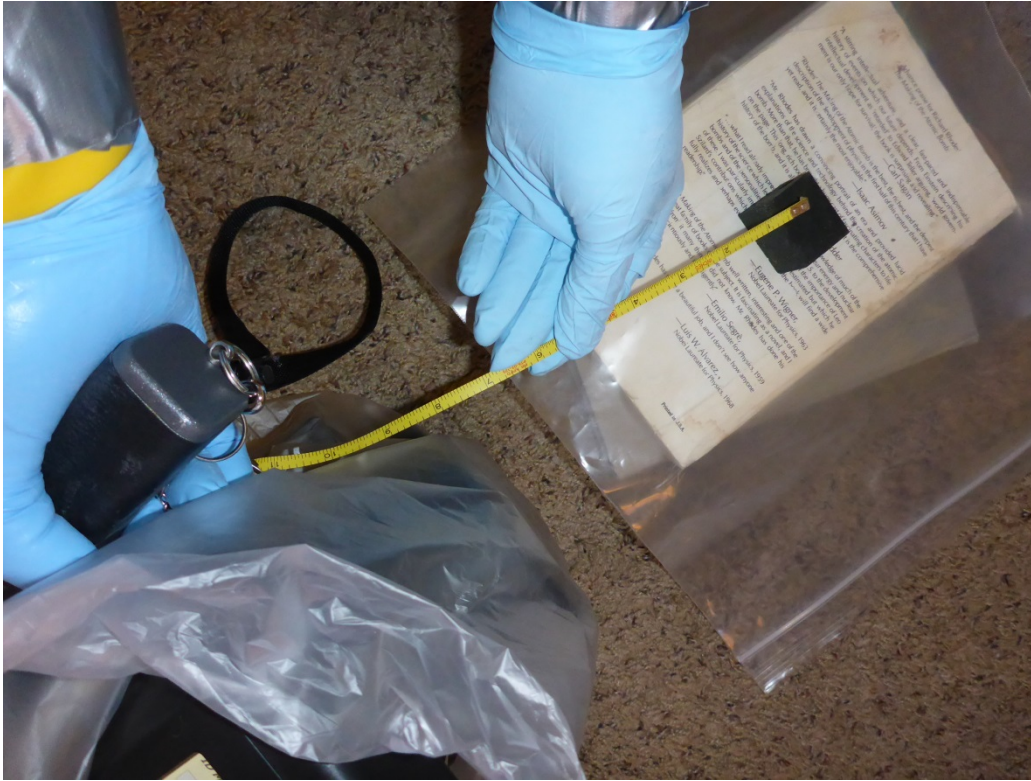


Figure #7: TE-14-2148 Addendum C, Black Cube Item, HPGe detector assay configuration.

Iter: 6

live-time(s) = 916.60  
chi-square = 1.55

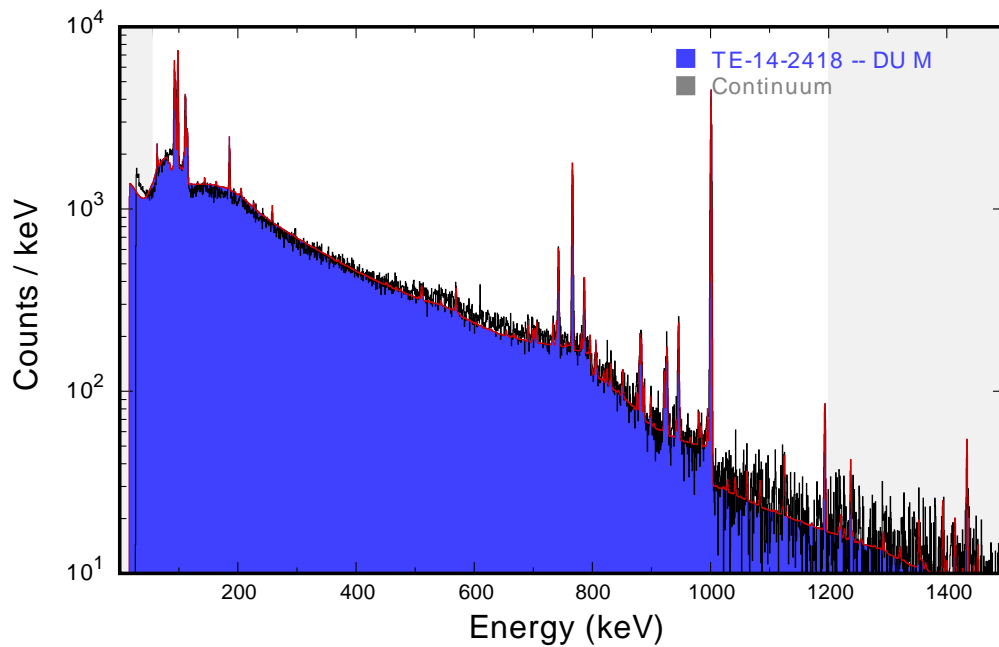


Figure #8: TE-14-2148 Addendum C, Black Cube Item, spectrum modeling outcome for depleted uranium metal of quantity 400-800 roughly, discussed further in the text.



Figure #9: TE-14-2148 Addendum D, patio deposition of “black powder”, HPGe detector assay configuration.

Iter: 4

live-time(s) = 1813  
chi-square = 2.18

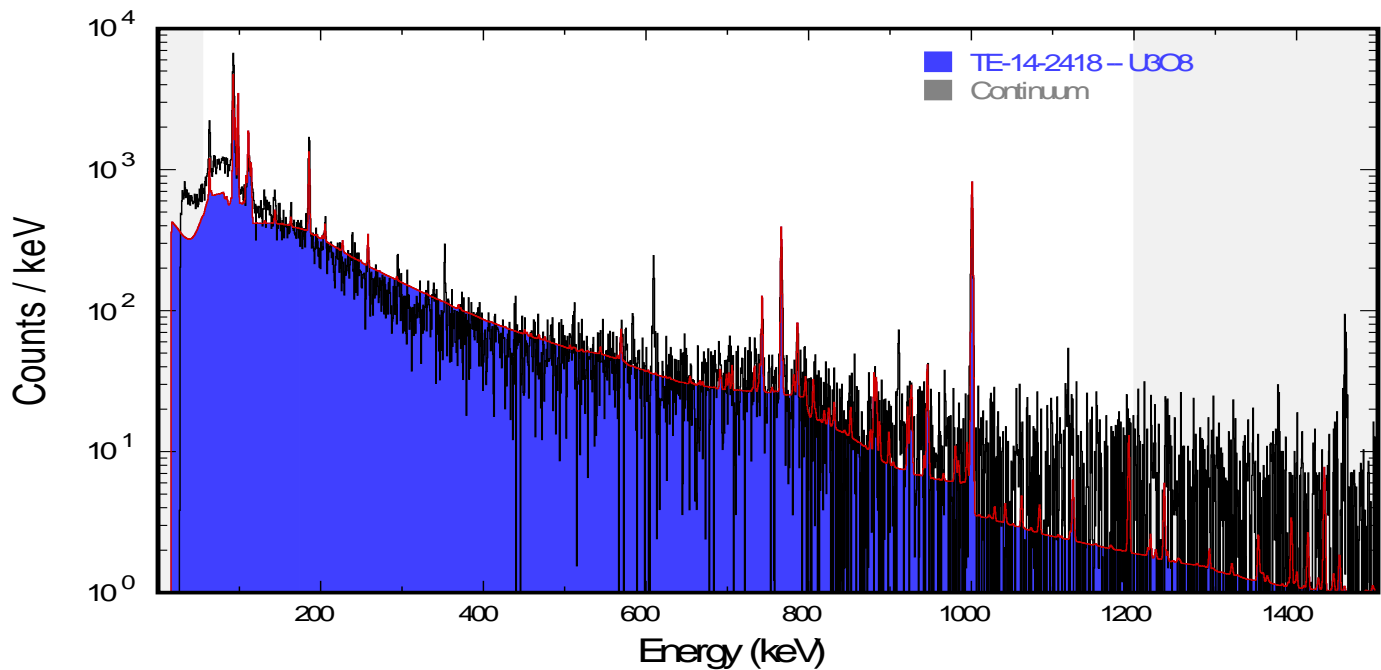


Figure #10: TE-14-2148 Addendum D, patio deposition of “black powder”, spectrum content is equally consistent with natural or depleted uranium, chemically separated > 90 days prior; oxide form is presumed from the photo.



Figure #11: TE-14-2148 Addendum E, photo of residence male bedroom, HPGe field of view without instrument, the foreground item in the photo is an archaic “Revigator” item, fabricated with the mineral carnotite with natural uranium oxide ( $\text{UO}_2$ ) bound in its mineral composition, used to infuse water with radon and its daughters.

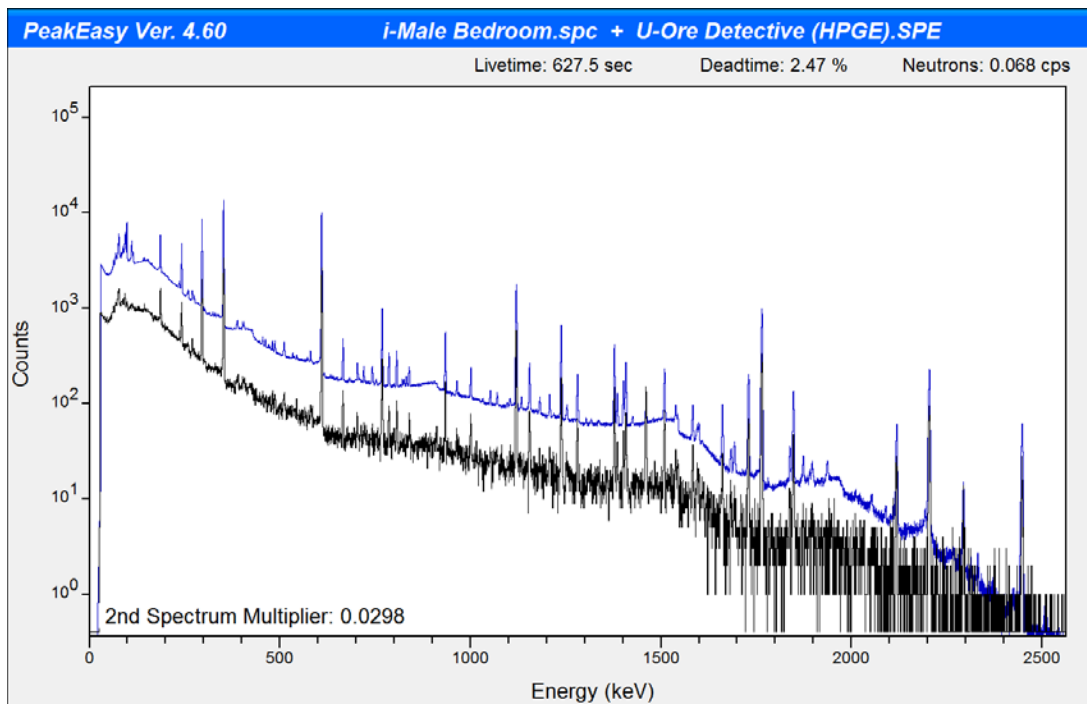


Figure #12: TE-14-2148 Addendum E, residence male bedroom, spectrum with natural uranium ore daughters present in quantitative equilibrium, including Pa-234m (1001 keV), compared with a uranium ore library spectrum.





Figure #13: TE-14-2148 Addendum F, black cube items in glass tube, HPGe detector assay configuration.

Iter: 7

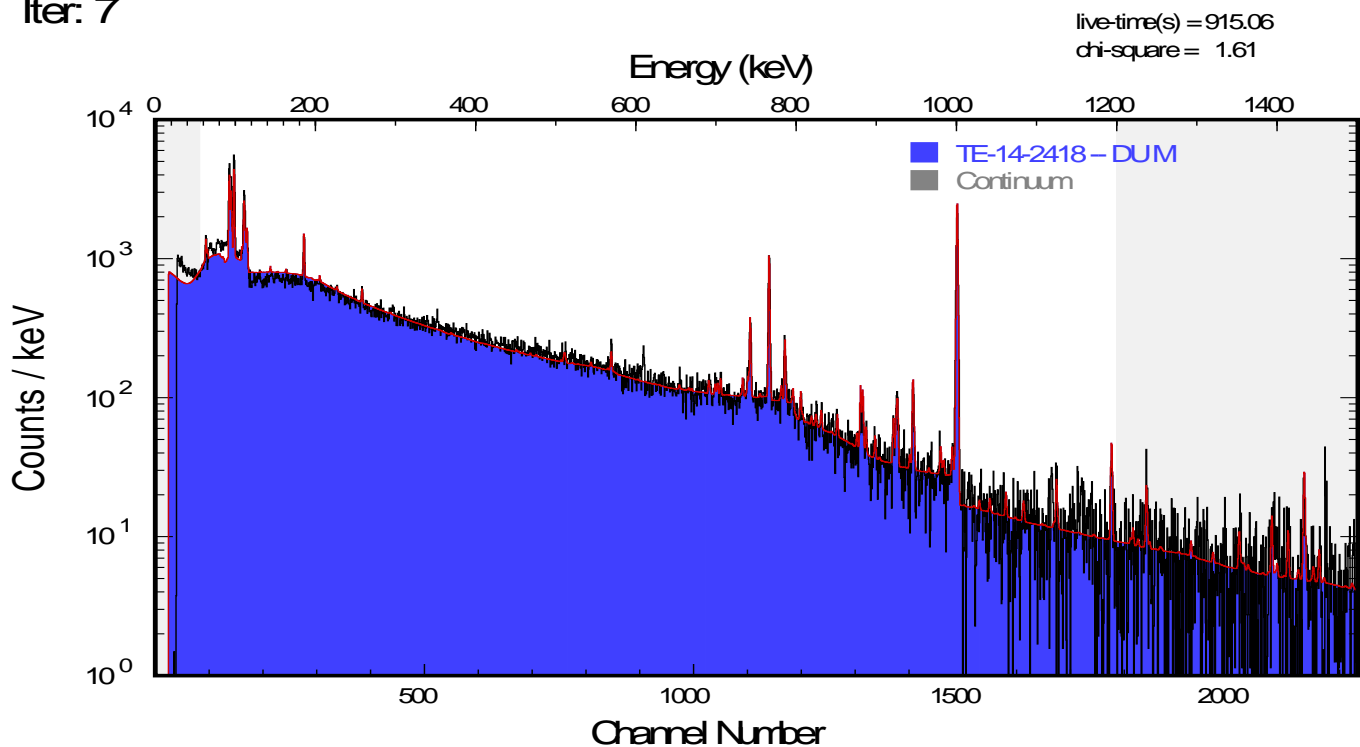


Figure #14: TE-14-2148 Addendum F, black cube items in glass tube, depleted uranium metal with rough mass 100-300 grams; spectrum modeling is more consistent with depleted uranium metal than with natural uranium.





Figure #15: TE-14-2148 Addendum G, residence male bathroom, HPGe detector assay configuration.

Iter: 4

live-time(s) = 621.22  
chi-square = 2.67

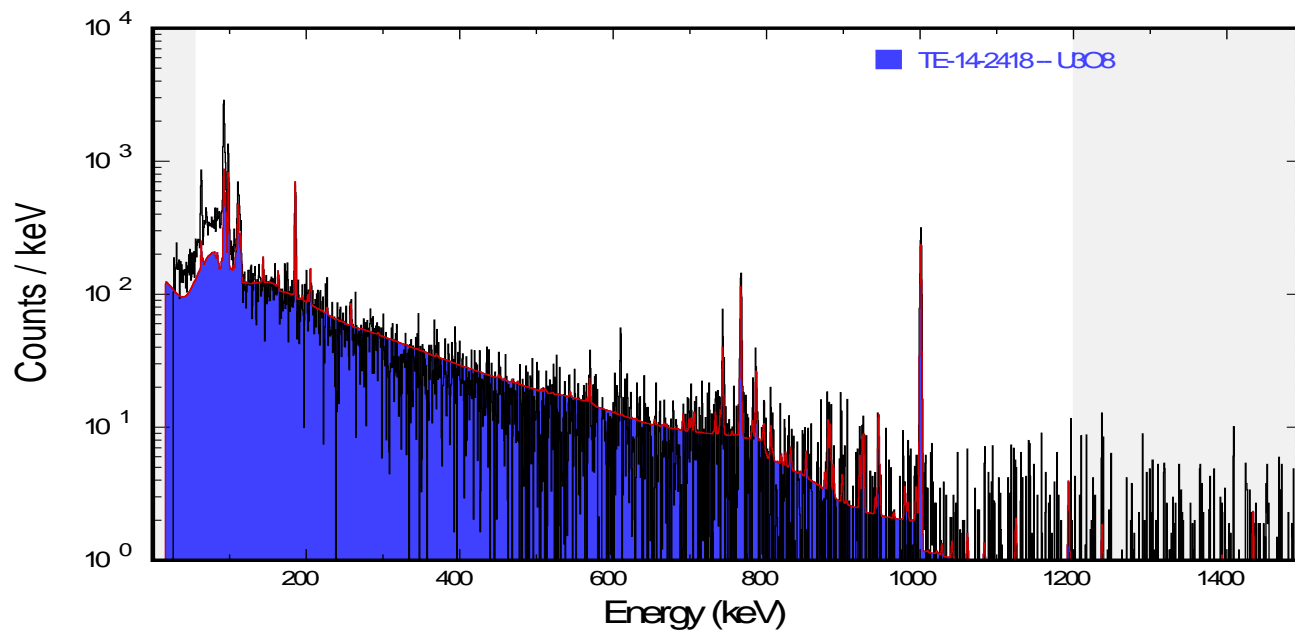


Figure #16: TE-14-2148 Addendum G, residence male bathroom, natural uranium oxide powder of quantity 50-100 grams (rough); spectrum content is consistent with natural uranium, chemically processed > 90 days prior; oxide form is presumed from the photo image.



Figure #17: TE-14-2148 Addendum H, residence female bathroom, HPGe assay configuration.

Iter: 5

live-time(s) = 336.30  
chi-square = 3.00

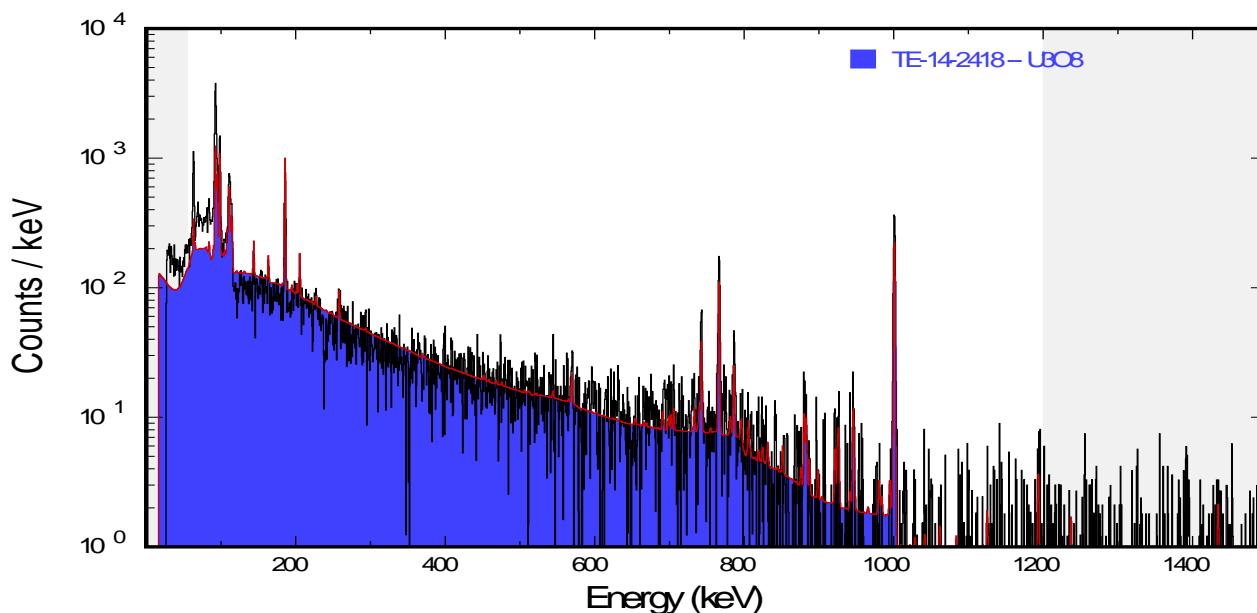


Figure #18: TE-14-2148 Addendum H, residence female bathroom, natural uranium oxide powder of quantity 5-20 grams (rough); spectrum content is consistent with natural uranium, chemically processed > 90 days prior; oxide form is presumed from the photo image.



Figure #19: TE-14-2148 Addendum I, residence male bedroom closet, HPGe field of view with instrument.

TE-14-2148.pcf,17<TE-14-2148.pcf,16

live-time(s) = 350.08  
chi-square = 0.40

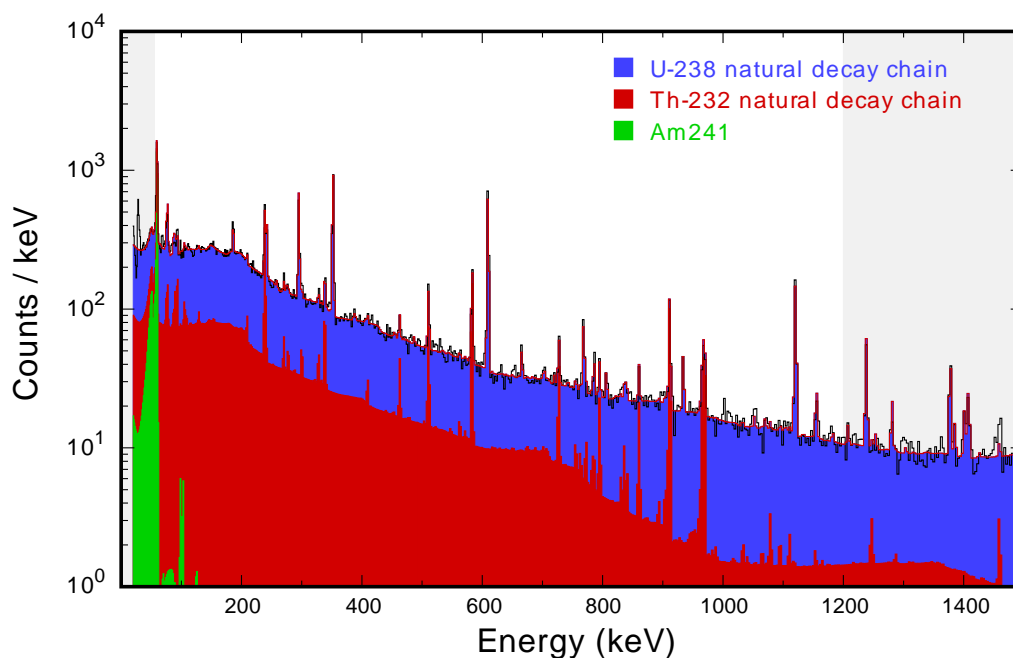


Figure #20: TE-14-2148 Addendum I, residence male bedroom closet, natural uranium and thorium ore decay chains are strongly present in appropriate equilibrium (no evidence of chemical processing); notable Am-241 is observed with light attenuation; the Am 241 item & quantity are undetermined within the field of view.





Figure #21: TE-14-2148 Addendum I, Photo P1000018.JPG, expanded view of the 2nd shelf from the bottom, shows partially dismantled commercial smoke detector with Am-241 source; discussed further in the text.

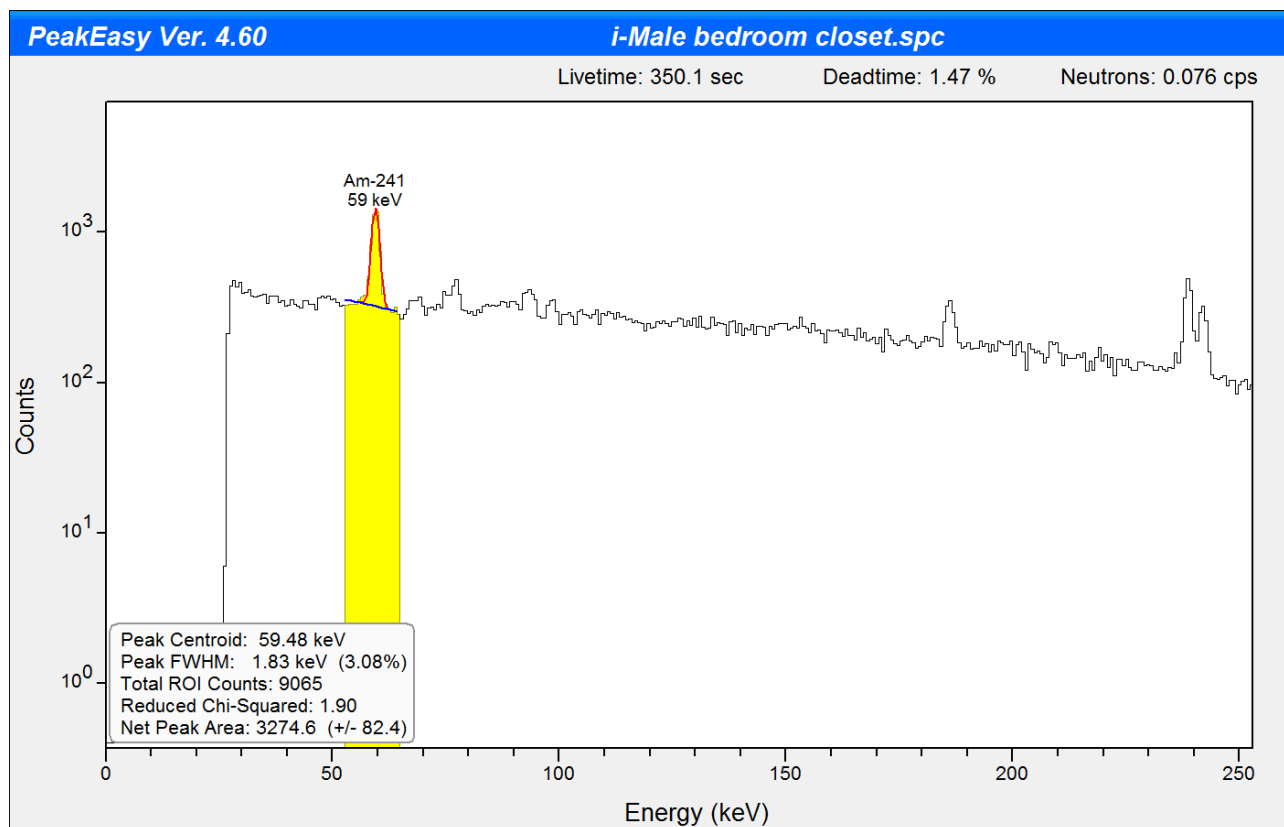


Figure #22: TE-14-2148 Addendum I, residence male bedroom closet, expanded low-energy view of the HPGe spectrum, displaying the significant elevation of Am-241 (59 keV) observed in this spectrum.



Figure #23: TE-14-2148 Addendum K, residence kitchen small vials, showing HPGe instrument.

Iter: 4

live-time(s) = 641.22  
chi-square = 1.40

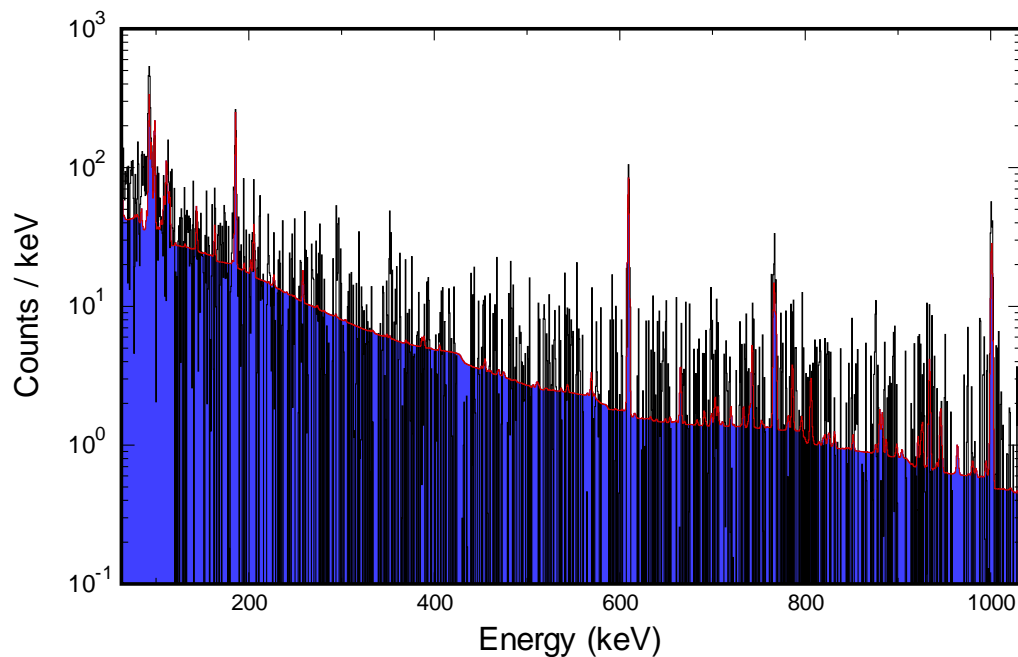


Figure #24: TE-14-2148 Addendum K, residence kitchen small vials, spectrum modeling (background subtracted) is consistent with natural uranium, chemically separated; further discussion in the text.



Figure #25: TE-14-2148 Addendum L, male bathroom liquid samples, grouped outside for HPGe assay.

Iter: 1

live-time(s) = 594.66  
chi-square = 1.46

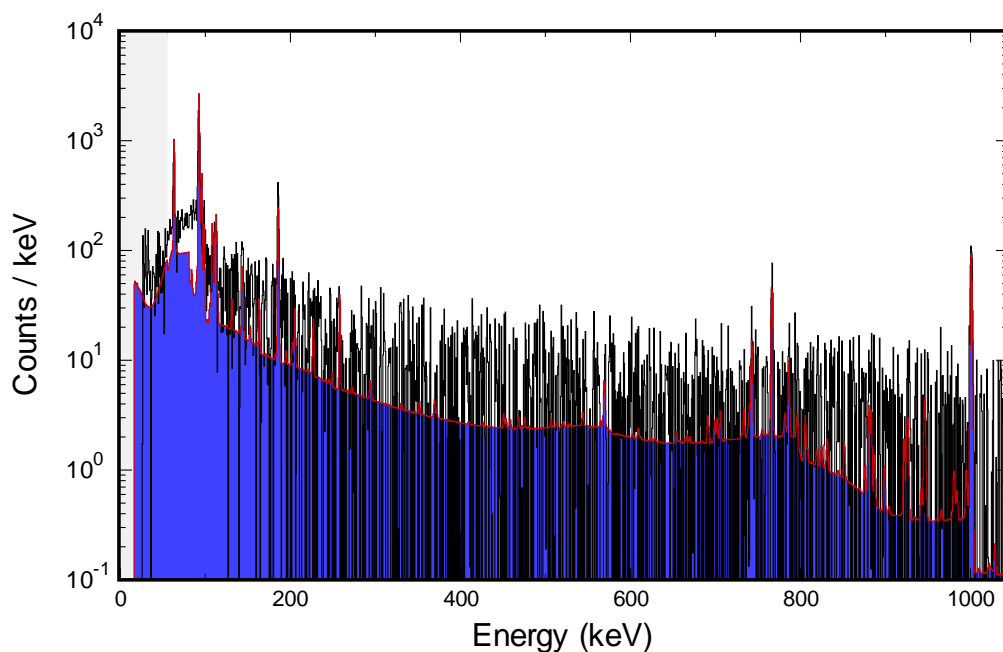


Figure #26: TE-14-2148 Addendum L, male bathroom liquid samples, spectrum modeling (background subtracted) is consistent with natural uranium in solution, chemically separated; further discussion in the text.





Figure #27: TE-14-2148 Addendum M, Small kitchen vial, left-most vial of green crystals, isolated for HPGe assay.

Iter: 8

live-time(s) = 766.88  
chi-square = 1.17

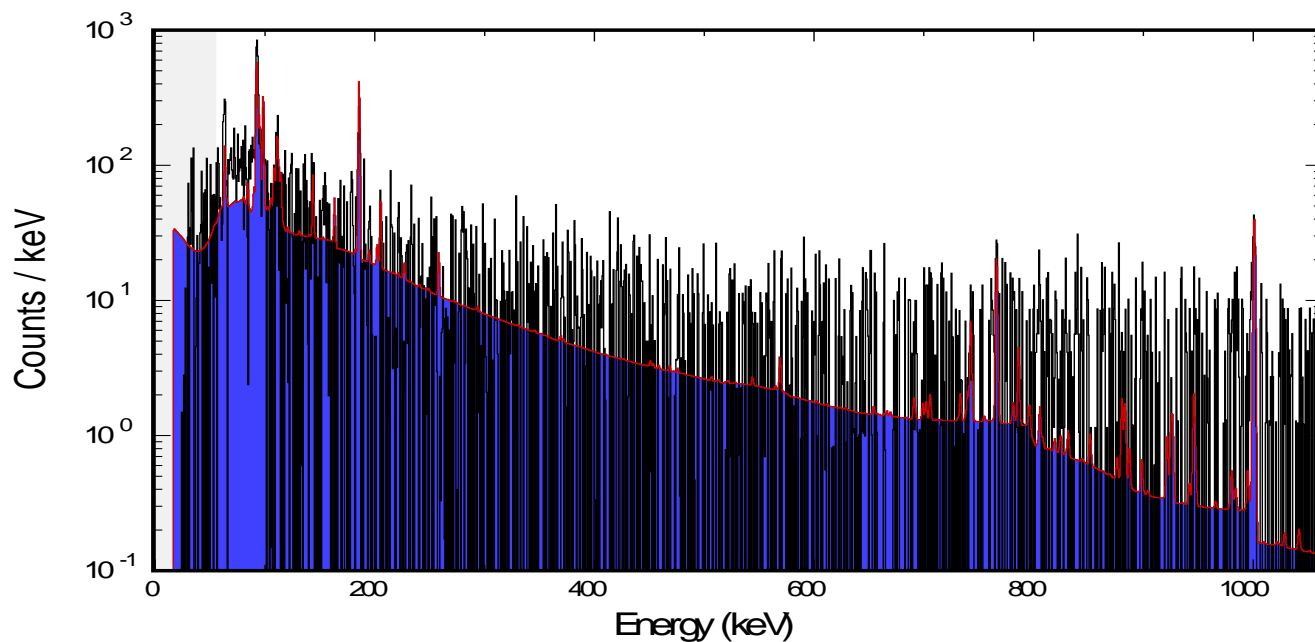


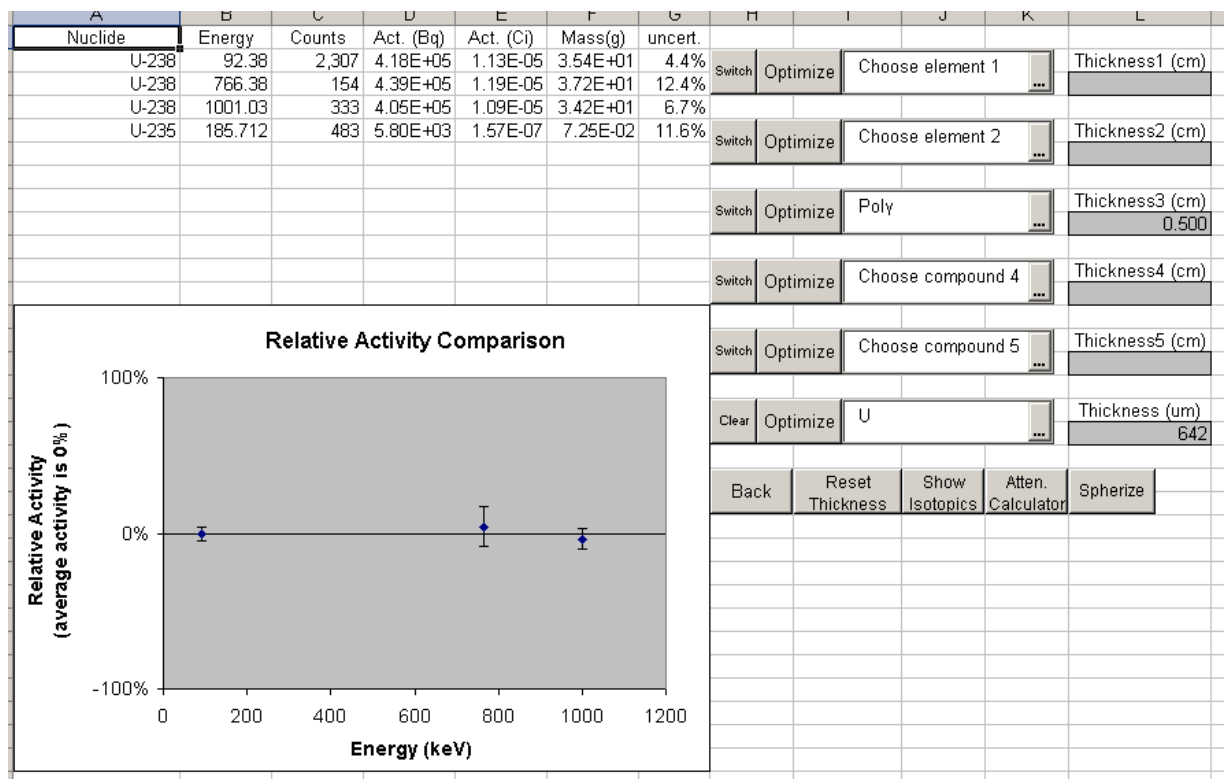
Figure #28: TE-14-2148 Addendum M, Small kitchen vial, left-most vial shown, spectrum modeling (background subtracted) is consistent with natural uranium oxide, chemically separated; further discussion in the text.



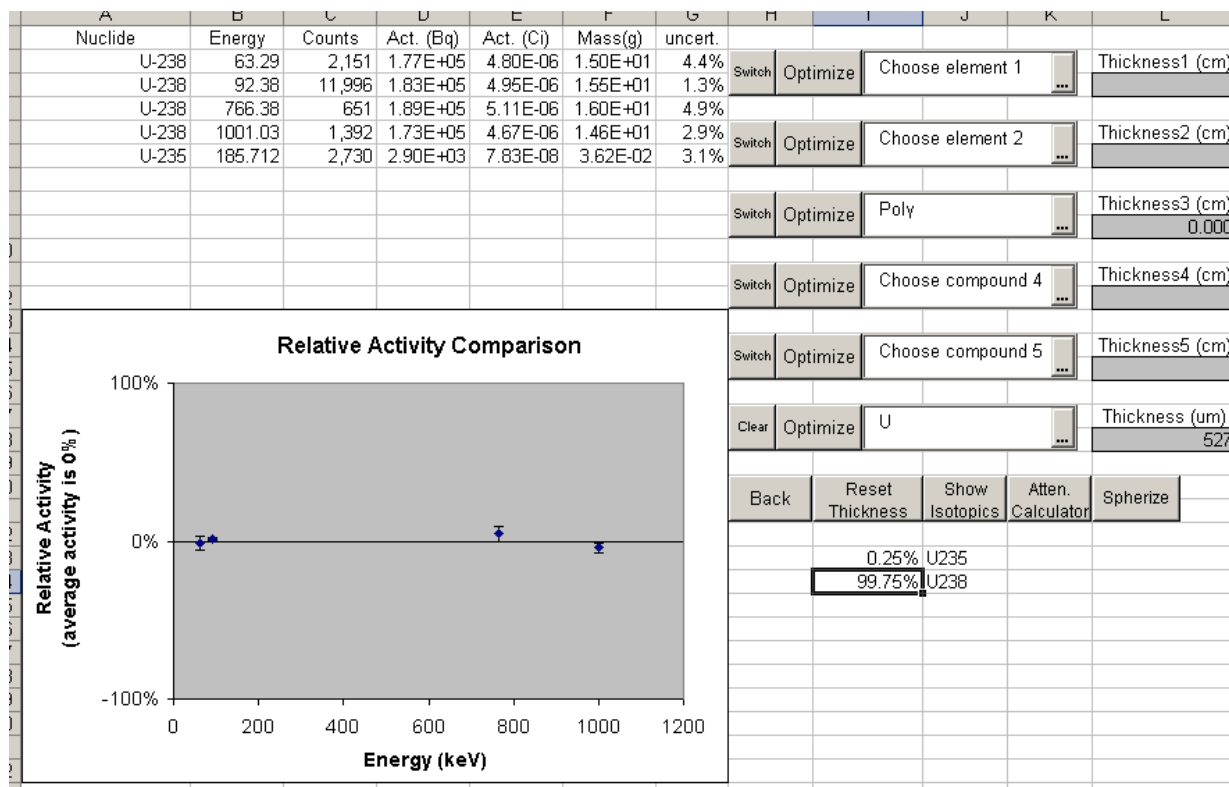


Figure #29: TE-14-2148 Addendum AB photograph o-(3) radium sources\_malebedroom).JPG also came with Addendum A (Photograph 25 in the “photo log” document). Along with clocks with radium dials, one can also see a neutron bubble detector with bubbles in the gel, potentially from past neutron exposure.

**TRIAGE EVENT NUMBER: TE-14-2148-A REV 6.1 (ACTUAL)**



**Figure #30: TE-14-2148 Simple Mass calculations for Addendum N, consistent with depleted uranium.**



**Figure #31: TE-14-2148 Simple Mass calculations for Addendum O, consistent with depleted uranium.**



**Figure #32: TE-14-2148 Addendum R measurement set-up, prior to placement of Tupperware container.**



**Figure #33: TE-14-2148 Addendum R, Tupperware with yellow liquid, total mass of 1.8 kg. Uranium metal and certain uranium oxides are soluble in inorganic acids such as nitric/sulfuric/hydrochloric, while being insoluble in water. Uranium concentrations in nitric acid can be as high as roughly ~ 600 grams of uranium/liter of solution.**

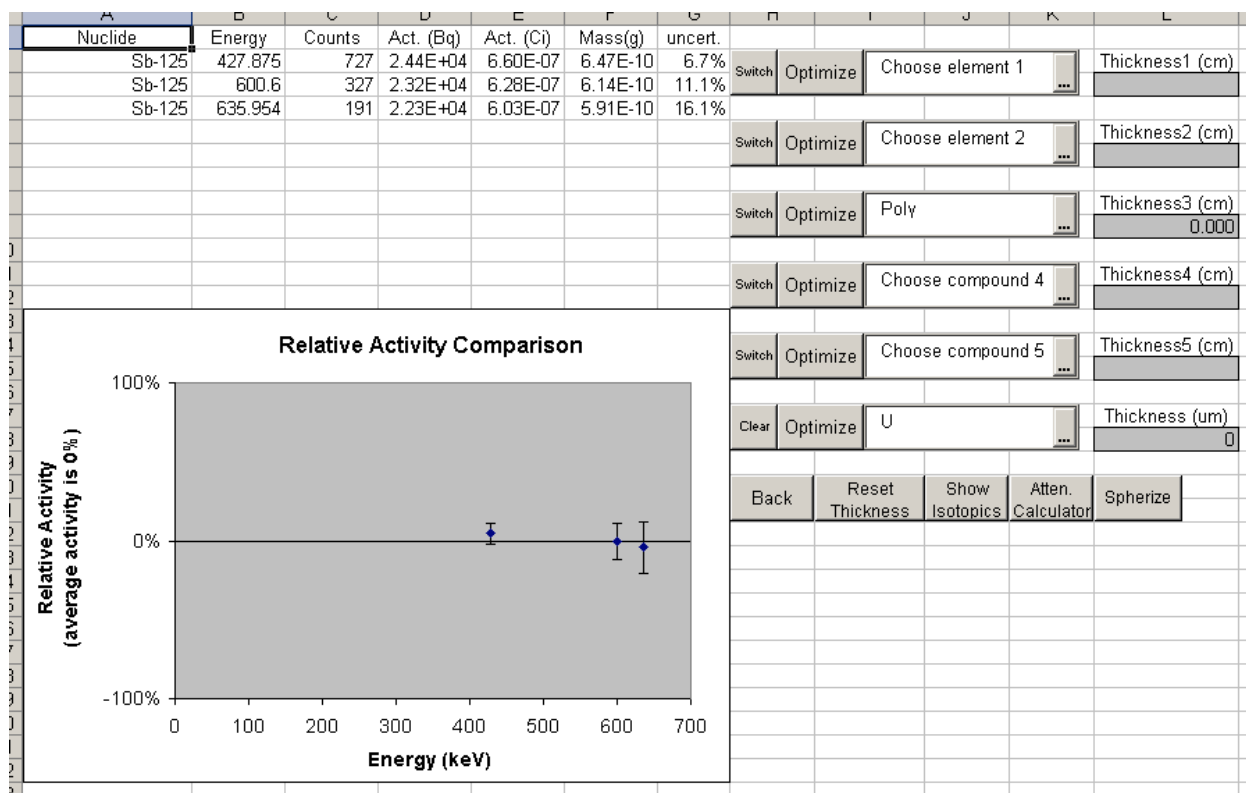


Figure #34: TE-14-2148 Addendum S, quantification of Sb-125 by Simple Mass.

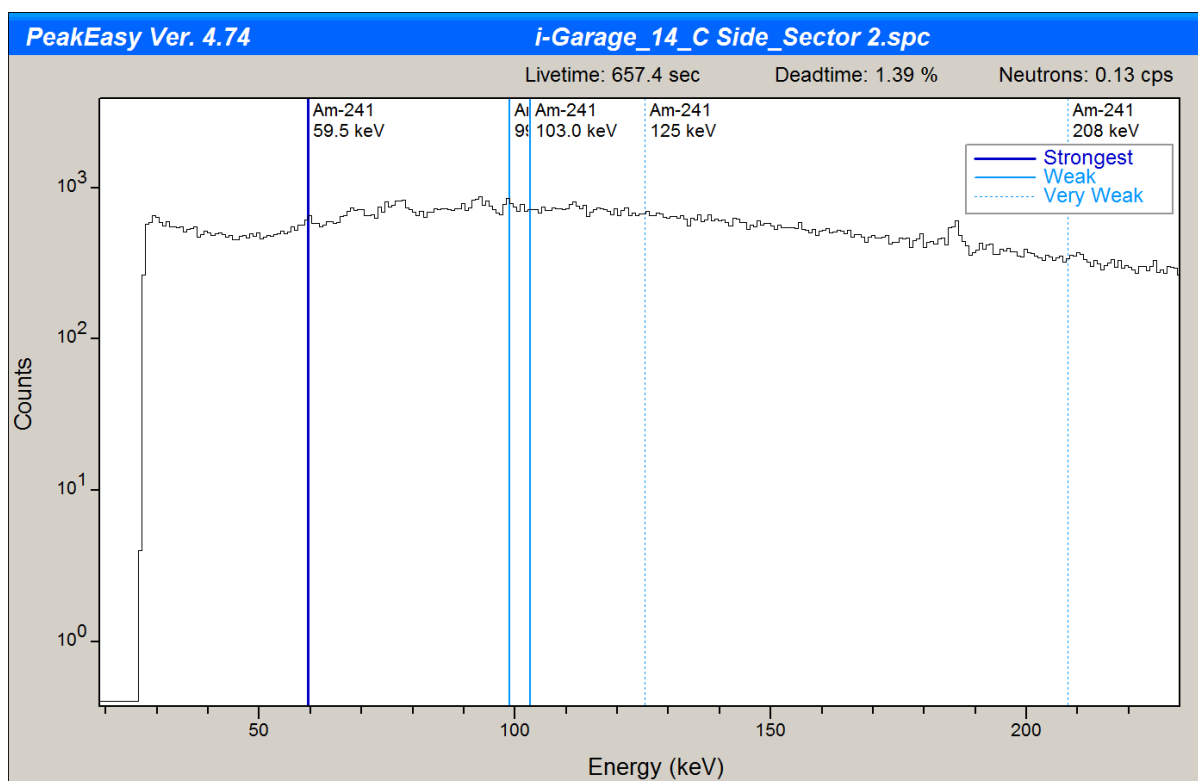


Figure #35: TE-14-2148 Addendum T, Am-241 peak still visible in the garage 14 C side sector 2 spectrum.



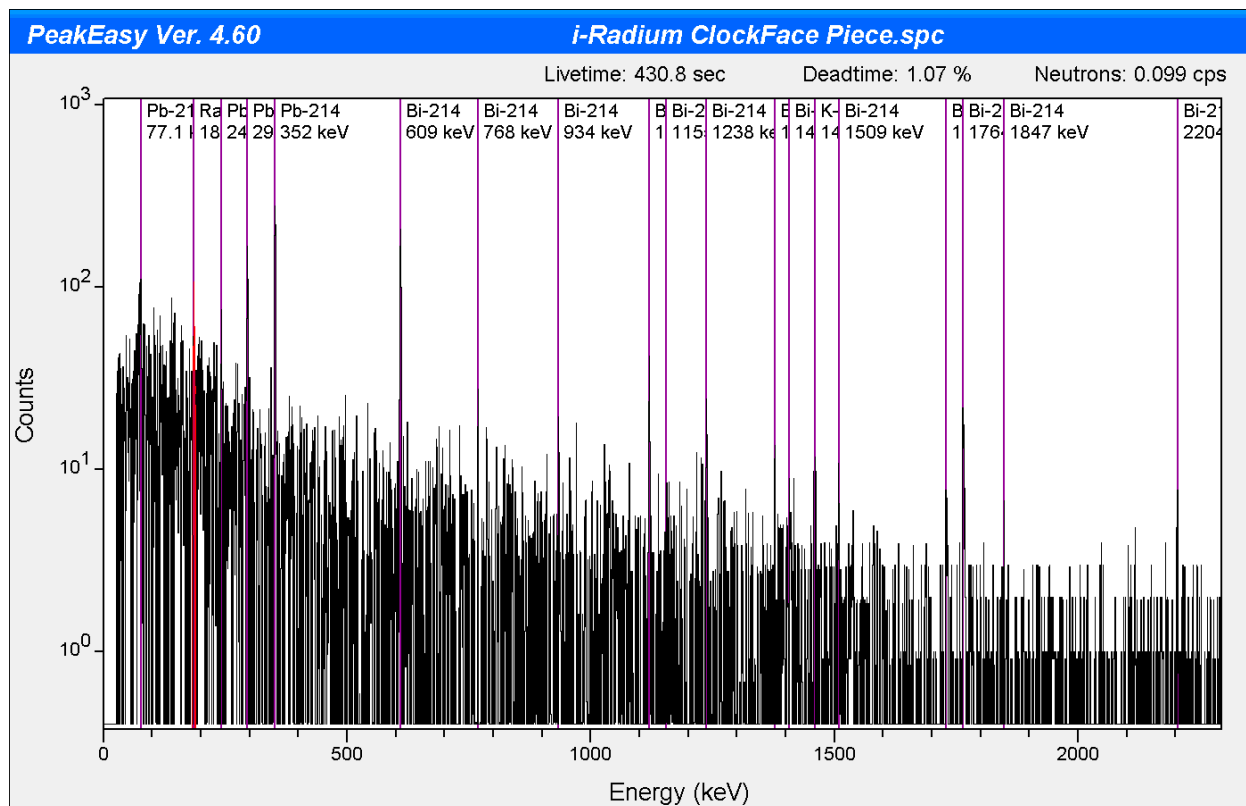


Figure #36: TE-14-2148 Addendum AA. Spectrum is consistent with Radium-226 and daughters Pb-214/Bi-214.

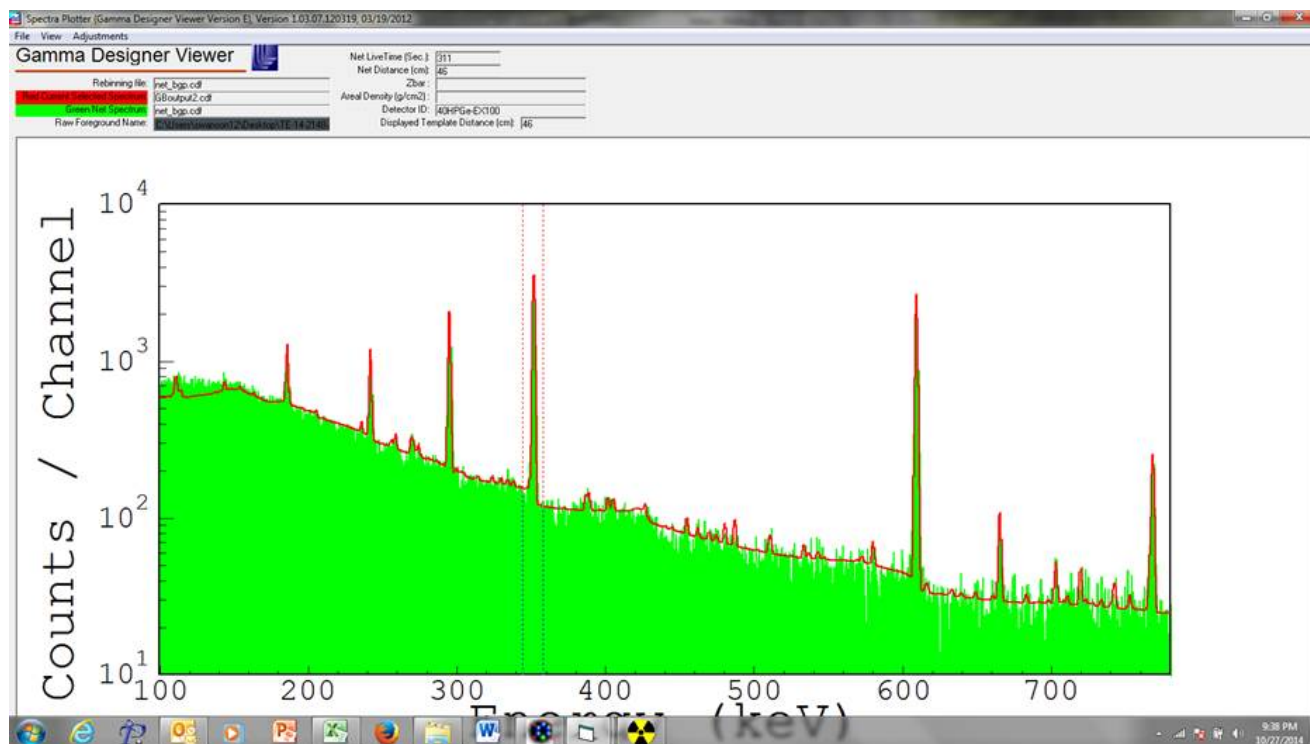


Figure #37: TE-14-2148 Addendum AC. This spectrum modeling fit (in red) is for a concrete hollow sphere (i.e. a 1-D model) with 32 grams of Natural Uranium oxide in the ceramic matrix, in full equilibrium as expected for the carnotite ore used in manufacturing legacy Revigators.